NUCLEAR SCIENCE ABSTRACTS

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NUCLEAR SCIENCE ABSTRACTS

A Publication of the United States Atomic Energy Commission Technical Information Service.

SCOPE

Nuclear Science Abstracts (NSA) is intended to serve scientists and engineers working in the field of atomic energy by abstracting as completely and as promptly as possible the literature of nuclear science and engineering. It covers not only unclassified and declassified research reports of the U. S. Atomic Energy Commission and its contractors, but also material that appears in research reports of other U. S. and foreign government agencies, universities, and industrial research organizations and in the technical and scientific journals.

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The Nuclear Data Sheets are available in a light-weight stock for insertion in binders and a heavy-weight stock for drawer filing. Annual subscription prices are $15 for the light and $18 for the heavy stock. Parcel post will be used in the U.S.A., printed matter mail elsewhere. Order from the Publications Office, National Academy of Sciences-National Research Council, 2101 Constitution Avenue, Washington 25, D. C.

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The printing of this publication has been approved by the Director of the Bureau of the Budget, July 30, 1957.

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ERRATA

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NSA Vol. 11, No. 14 Suppl., p. 805. In abstract 7453, B. L. Zebroski should be E. L. Zebroski.

NSA Vol. 11, No. 14 Suppl., p. 862. In abstract 7888, Frank W. Faris should be Frank E. Faris.

NSA Vol. 11, No. 15 Suppl., p. 925. In abstract 8422, J. R. Flannary should be J. R. Flanary.

NSA Vol. 11, No. 15 Suppl., p. 952. In abstract 8659, R. W. Winget should be R. H. Winget.

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GENERAL

15185 TID-3043(Rev. 1)
Technical Information Service Extension, AEC.
UNCLASSIFIED BIBLIOGRAPHIES OF INTEREST TO THE ATOMIC ENERGY PROGRAM. Hugh E. Voress and Naomi K. Smelcer, comps. Feb. 1958. 163p. $3.00(OTS).

This compilation contains 1556 references to bibliographies and literature surveys on atomic energy. References listed in TID-3043 and TID-3043(Suppls. 1 and 2) and additional selected references to report and published literature are included. The bibliographies are arranged by subject, and multiple listings are made for bibliographies that cover more than one subject. The subjects are listed in the Contents. Author and report number indexes are provided. (auth)

15186 UCRL-Trans-358(L)(p.1-2)
CONSTRUCTIVE EXPLOSIONS—CHINA. G. Pokrovskii. Translated by Sergey Shewchuck (Univ. of Calif., Livermore) from Tek. Molodezhi 7, 7(1957). 2p.

A description of a large explosion in China for the construction of quarries is presented. (W.L.H.)

15187 UCRL-Trans-358(L)(p.3-19)
PHYSICS OF EARTH WORKS. G. Pokrovskii. Translated by Sergey Shewchuck (Univ. of Calif., Livermore) from Tek. Molodezhi 2, 9-12(1953). 16p.

Various methods of moving vast quantities of earth are presented. The methods considered are earth-digging machines, hydro-mechanization, and explosives. (W.L.H.)

15188 UCRL-Trans-358(L)(p.20-40)
BEGINNING OF AN ERA OF ATOMIC ENERGY. G. Pokrovskii. Translated by Sergey Shewchuck (Univ. of Calif., Livermore) from Tek. Molodezhi 9, 2-6(1954). 21p.

The construction of the first Russian atomic power station is presented along with a discussion of nuclear energy and future developments in nuclear energy. (W.L.H.)

15189

ABSTRACTS OF THE PAPERS PRESENTED AT THE 2nd JAPAN ISOTOPE CONFERENCE, FEBRUARY 4-6, 1958. [Tokyo], Japan Atomic Industrial Forum, 1958. 262p.

A program for the Second Japanese Isotope Conference, Feb. 4, 5, and 6, 1958, is presented in English. The papers cover both industrial and medical uses of isotopes. Abstracts are included in Japanese of papers presented at the conference. (C.H.)

15190

FINANCIAL PROTECTION AGAINST ATOMIC HAZARDS: THE INTERNATIONAL ASPECTS. Preliminary Report. May 1958. New York, Atomic Industrial Forum, Inc., 1958. 80p. $1.00.

Nuclear liability refers to the legal and financial consequences of a serious atomic industrial accident, notably one involving radioactive fall-out, on the environment. A study was made of the international aspects of the problem of nuclear liability. Preliminary conclusions are presented. Factors considered include the enforcement of foreign judgments in the United States, direct suites in the United States, private arrangements to limit liability, possible actions by the United States government and the present status of international agreements and foreign legislative action. (C.H.)

15191

RESEARCH ON POWER FROM FUSION AND OTHER MAJOR ACTIVITIES IN THE ATOMIC ENERGY PROGRAMS. Washington, United States Atomic Energy Commission, 1958. 422p. Available from U. S. Government Printing Office, Washington, for $1.25.

Brief reports are given of developments in: raw materials, special nuclear materials, military applications, international activities, commercial and isotope development, legal aspects, inspection, reactor development, classification and declassification, information activities, education and training, physical research, biology and medicine, nuclear materials management, construction and supply, community activities, new headquarters, and organization and personnel. The AEC controlled thermonuclear fusion program is described in detail, the four major approaches to the problem being discussed. Appendixes are given summarizing or tabulating information on personnel, isotopes, installations, publications, regulations, licenses, and including remarks on: precautions for Eniwetok tests, domestic mining and milling problems, radioactive fall-out, seismological detonations, Euratom, and the Oak Ridge nuclear incident. (T.R.H.)

Atomic Bombs and Warfare

15192

CONDUCT OF POPULATION DURING AN ATOMIC ATTACK. M. Arkhipov and A. Dorofeyev. Kryl'ya Rodiny No. 3, 31(1958). (In Russian)

The loss in human lives and material in an atomic air attack can be greatly reduced by adequate warnings and preventive measures. The preventive measures to

be taken by the Russian population are described. The conduct of the population following the warning and the type of warnings given are discussed. (J.S.R.)

Atomic Power

15193 GC(II)/39

International Atomic Energy Agency, Vienna.
FIRST ANNUAL REPORT OF THE BOARD OF GOVERNORS TO THE GENERAL CONFERENCE COVERING THE PERIOD FROM OCTOBER 23, 1957 TO JUNE 30, 1958. July 1958. 57p.

Information is given on the following topics: the work of the board and relations with member states, relations with the United Nations and other organizations, the administration of the agency, and the operations of the agency. (T.R.H.)

15194

POWER STATION REACTORS—AMERICA LOOKS AHEAD. Atomics and Nuclear Energy 9, 264-7(1958) Aug.

This survey of American plans and purposes in the field of nuclear power is based on the U.S.A.E.C. report to a Congressional committee. It shows the differences between the British and American approach to the whole field of nuclear power. (L.T.W.)

15195

AMERICAN PROSPECTS FOR ECONOMIC NUCLEAR POWER. W. Kenneth Davis and Lewis H. Roddis, Jr. (U. S. Atomic Energy Commission, Washington). Atomics and Nuclear Energy 9, 268-70, 279(1958) Aug.

An abundance of Cheap fossil fuels in America has made the rapid development of a nuclear power program completely unnecessary. The Shippingport power station was constructed for prestige purposes more than anything else. The policy appears to be erect small demonstration plants, like the Dresden plant, each of different design, to establish the best reactor models for future development. Installed nuclear capacity of about 2.5 million kw should be available by the end of 1964. At the present time capital costs for nuclear plants are expected to range from $300 to $400 per kw of capacity compared to costs for coal-fired plants which vary from about $115 to $180 per kw, depending on location. It appears that by 1975 nuclear power may become competitive with power from coal- or oil-fired plants. (A.C.)

15196

NUCLEAR POWER PLANS OF POLAND. J. P. Nowacki. Atomics and Nuclear Energy 9, 274-5, 279(1958) Aug.

At present Poland has all the coal she needs, but coal exports play an important part in the economy and the expected increase in demand for electricity will consume excess production by 1975. Nuclear power stations will then become essential. While the first is not planned to operate before 1965, in the intervening period Poland can gain from the experience of the pioneering nations. The author, who is in charge of his country's nuclear development plants, outlines Polish plans. (auth)

15197

NEW APPLICATIONS OF RADIO ELEMENTS AND OF RADIATION TO INDUSTRY. P. Levêque (Centre d'Études Nucleaires, Saclay, France). Énergie nucléaire 2, 67-72(1958) Apr.-June. (In French)

The French experiences in the industrial utilization of radioisotopes are described. These applications include thickness gaging, measurement of flow rate, study of the evolution of gravel and alluviums, and preparations of the chemical industry. The principal radioisotopes used are listed, and the procedure for using them is briefly described. The large and interesting possibilities of these techniques are emphasized, and the limitations because of the dangers of contamination and because of the rarity or high price of the products are discussed. (tr-auth)

15198

NUCLEAR PHYSICS—TO SERVE THE NATIONAL ECONOMY. S. A. Azimov. Nauka i Zhizn' No. 4, 23-5 (1958). (In Russian)

A description is given of the instrumentation and primary interests of the Institute of Nuclear Physics of the Uzbek SSR Academy of Sciences. The Institute is investigating elementary particles, utilization of marked atoms in biology, medicine, and technology, and the application of isotopes and radiation in industry and agriculture. (J.S.R.)

15199

AEC'S FUEL PROGRAM. R. Carson Dalzell, W. Kenneth Davis, Clark Goodman, and Ulysses M. Staebler (U. S. Atomic Energy Commission, Washington). Nucleonics 16, No. 8, 78-81(1958) Aug.

The objectives of the AEC's over-all fuel program are to develop more efficient fuels for reactors using U^{233}, U^{235}, natural U, and Pu, to utilize these fuels at elevated temperatures to increase burnup, and to develop fabrication techniques and manufacturing processes that will lower the unit costs of producing fuel elements. The development of ceramics and their fabrication are two important problems which must be solved in the increase of nuclear efficiency by attainment of higher temperatures. The development of bred fuels is emphasized. (J.S.R.)

15200

U. S. EXPORT POLICIES. Myron B. Dratzer (U. S. Atomic Energy Commission, Washington). Nucleonics 16, No. 8, 82-5(1958) Aug.

The terms and conditions of availability from the U.S. of the principal nuclear materials and related services are summarized and the principles behind them are discussed. (J.S.R.)

15201

URANIUM. 1. THE CASE FOR ENRICHED URANIUM. Chauncey Starr (Atomics International, Canoga Park, Calif.). 2. THE CASE FOR NATURAL URANIUM. John R. Menke (Nuclear Development Corp. of America, White Plains, N. Y.). 3. URANIUM ALLOYS AND DISPERSIONS. R. A. Noland, J. F. Schumar, and J. H. Kittel (Argonne National Lab., Lemont, Ill.). 4. URANIUM OXIDE EXPERIENCE. J. C. Danko (Westinghouse Electric Corp., Pittsburgh). Nucleonics 16, No. 8, 86-90, 95(1958) Aug.

The advantages of the use of enriched uranium, natural uranium, uranium alloys and dispersions, and uranium oxides are discussed in four separate sections. The principal reason for the use of enriched uranium is the consistent indication that this fuel will cost less. Its main disadvantages are the higher basic fuel cost and the necessity for isotope separation plants and chemical reprocessing facilities. The chief advantage of natural uranium fuel is that reactors using it are operable on a universally available fuel. The disadvantages are the cost of the heavy water and the fact that heavy water reactors tend to be larger in size. As a nuclear material, unalloyed uranium has the disadvantage of extensive anisotropic dimensional changes and surface roughening under irradiation. Alloys which are

highly effective when combined with suitable heat treatment and/or fabrication techniques are described. Uranium oxide, because of its physical properties and excellent resistance to radiation damage, can be used in reactors operating at low, intermediate, and high temperatures. UO_2 fabrication, physical properties, radiation damage, and fuel-element fabrication are discussed. (J.S.R.)

15202

THORIUM. Bernard Manowitz (Brookhaven National Lab., Upton, N. Y.). Nucleonics 16, No. 8, 91-5(1958) Aug.

The advantages of the $Th-U^{233}$ fuel cycle for the reactor designer are discussed. The reactor physics, solid-fuel studies, ore processing, chemical reprocessing, and radiation problems are described. (J.S.R.)

15203

PLUTONIUM. Nucleonics 16, No. 8, 96-100(1958) Aug.

The long-term, efficient use of the U^{235} reserves requires the conversion of U^{238} to plutonium in fast breeder reactors. The properties of Pu and its alloys, handling and fabrication problems, and the development of prototype fuel elements are discussed. (J.S.R.)

15204

RADIOISOTOPES IN RUSSIA. Henry J. Gomberg (Univ. of Michigan, Ann Arbor). Nucleonics 16, No. 8, 136, 138-41(1958) Aug.

A visit to Moscow to attend the All Union Conference on Application of Radioactive and Stable Isotopes in the National Economy and Service is described. The papers on radiobiology are briefly described and the work compared with that done in the U.S. Visits made to several laboratories are also discussed. (J.S.R.)

Research Programs

15205 GC(II)/36

International Atomic Energy Agency, Vienna.
PROGRAMME AND BUDGET FOR 1959. Aug. 1958. 99p.

15206

INSTITUTE OF NUCLEAR SCIENCE OF THE WEIZMANN INSTITUTE OF SCIENCE, REHOVOTH, ISRAEL. M. A. Hirshfeld (Weizmann Inst. of Science). Nature 182, 494-6(1958) Aug. 23.

Buildings and facilities of the Institute of Nuclear Science of the Weizmann Institute of Science, Rehovoth, Israel, are described. The research program is outlined. (C.H.)

15207

INDUSTRIAL UTILIZATION OF RADIOISOTOPES IN JAPAN, 1958. Tokyo, International Cooperation Administration, Japan Productivity Center, 1958. 49p.

The extent of the utilization of radioisotopes in Japan, facilities for radiation research, research in industrial uses of radioisotopes, practical applications of radioisotopes, radiation standards, production of instruments and equipment, procedures for the safe handling of radioisotopes and radioactive waste disposal, training programs in radioisotope techniques, and information exchange policies are discussed. (C.H.)

15208

RECENT DEVELOPMENTS IN URANIUM MILLING TECHNOLOGY. Transcript of the Mill Technology Symposium and Addresses from the Annual Meeting, May 17-18, 1957, Denver, Colorado. Grand Junction, Colorado, Uranium Institute of America, [1958]. 107p. $5.00.

The following reports are included; A Reconnaissance of Uranium Process Technology, Uranium Concentrate Specifications, Recent Studies in Dapex Processing for Uranium and Amex Processing for Thorium, Continuous Ion Exchange Treatment for Ore Leach Liquors, Recent Developments in the Study of Uraniferous Lignite Treatment, Direct Solvent Leaching of Uranium Ores, Thorium and Uranium Stockpiling and Nuclear Fuels, and The Utility Industry Prepares for the Atom. (D.E.B.)

15209

UNITED KINGDOM ATOMIC ENERGY AUTHORITY FOURTH ANNUAL REPORT FOR THE PERIOD 1st APRIL 1957—31st MARCH 1958. London, Her Majesty's Stationery Office, 1958. 74p. $0.81.

A summary is presented of activities in the field of atomic energy engaged in during the period from April 1957 to April 1958. The status of raw material procurement, processing plants, reactor development, thermonuclear studies, radiochemical studies, isotopes and irradiation programs, health and safety activities, and cooperation with other international organizations is discussed. (C.H.)

BIOLOGY AND MEDICINE

15210

EFFECT OF GLUCOSIDATION ON RADIOMIMETIC ACTIVITY. COMPARISON OF HYDROQUINONE AND ITS GLUCOSIDE, ARBUTOSIDE. Guy Deysson and Rene Truhaut (Institut du Cancer Gustave Roussy et Faculte de Pharmacie). Compt. rend. soc. biol. 151, 1719-22(1957) Oct. (In French)

Investigations were made to compare the radiomimetic effects of hydroquinone and its natural glucoside arbutoside on the roots of Allium sativum L. The results of the study showed that arbutoside exercises a radiomimetic action of the same type as hydroquinone, but of an intensity 4 times less. The glucosidation diminishes the toxicity and the efficiency of hydroquinone, but it does not remove the effect exercised on the chromosomes. (J.S.R.)

15211

THE ACCUMULATION OF NATURALLY RADIOACTIVE ELEMENTS BY SOIL MICROORGANISMS. N. A. Krasilnikov, A. A. Dorbkov, and O. G. Shirokov (Lomonosov Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 120, 1136-7(1958) June 11. (In Russian)

Methods are developed for determining the capacity of soil organisms for absorption of natural radioactive elements. It is shown that various types of microörganisms accumulate various quantities of radioactive elements. In substrata, where the concentrations of radioelements are very small (uranium 10^{-5} to 10^{-4}, thorium 10^{-5} to 10^{-4}, and radium 10^{-10} to 10^{-9}), some bacteria accumulate considerable quantities which can be used as indication of substrata enrichment. (R.V.J.)

15212

AGE DEPENDENCE OF THE NATURAL RADIUM CONTENT. B. Rajewsky, H.-J. Hantke, and H. Muth (Max-Planck-Institut fur Biophysik, Frankfurt am Main). Z. Naturforsch. 13b, 474-5(1958) July. (In German)

To determine the effect of age on the natural radium content of chickens, the radium content was determined from the hatching to adulthood. The chickens were raised in cages and were fed with pressed feeds containing all necessary nutrients and vitamins. The animals were dismembered, incinerated at 600°C, and the ashes were dissolved. The radium content and the cal-

cium content were determined. The average radium content of the food was 13.5×10^{-15} g Ra/g food and the average calcium content was 0.014 g Ca/g food. The results showed that up to the moulting period the radium content of hens and roosters was the same. After the moulting, which produces a strong disturbance of the normal mineral metabolism, the rooster maintains a single equilibrium value. It was also found that the percentage retention of calcium is from 4 to 20 times that of radium according to the age of the animal. (J.S.R.)

15213

PROCEEDINGS OF THE INTERNATIONAL GENETICS SYMPOSIA, 1956, TOKYO & KYOTO, SEPTEMBER, 1956. Tokyo, International Genetics Symposia, 1956, Science Council of Japan, 1957. 702p.

Topics discussed include chromosome structure and mitosis, the chemistry of chromosomes, cytological aspects of cancer, induced mutations, polyploidy, heterosis, resistance, polygeneic inheritance, microörganisms and viruses, and blood groups. (C.H.)

15214

PROCEEDINGS OF THE SIXTH INTERNATIONAL CONGRESS OF THE INTERNATIONAL SOCIETY OF HEMATOLOGY, BOSTON, AUGUST 27–SEPTEMBER 1, 1956. New York, Grune & Stratton, 1958. 948p.

The accumulated contributions of the participants in the 6th International Congress of Hematology, held in Boston, 1956, are presented. The papers are grouped under the headings of leukemia, nucleonics, spleen and hypersplenism, hemorrhagic disorders, anemia, and immunohematology. Papers are included which were presented by members of a panel on the harmful effects of irradiation on hemopoiesis. (C.H.)

Radiation Effects

15215 AECU-3811

Southern Illinois Univ., Carbondale. Biological Research Lab.

THE EFFECTS OF ENVIRONMENT (RADIATION, SUBSTRATE AND ALLELIC GENES) ON THE MELEZITOSE GENE IN SACCHAROMYCES. Carl C. Lindegren and David D. Pittman. 1958. 6p. Contract AT(11-1)-424. $1.80(ph OTS); $1.80(mf OTS).

The effects of ultraviolet radiation, x radiation, substrate, and allelic genes on the melezitose gene, which controls the formation of the adaptive enzyme, melezitase, was investigated in cultures of Saccharomyces. Results indicate that x rays render the gene mutable and melezitase specifies the mutation. (C.H.)

15216 ANL-5841

Argonne National Lab., Lemont, Ill.

BIOLOGICAL AND MEDICAL RESEARCH DIVISION SEMIANNUAL REPORT [FOR] JULY THROUGH DECEMBER 1957. Mar. 1958. 204p. Contract W-31-109-eng-38. $3.50(OTS).

Progress is reported in the following studies: factors affecting the production of antibodies in irradiated rabbits; the effects of irradiation on the serological activity of ovalbumin; factors affecting the growth of transplanted mouse ascites carcinomas in rats; the effects of strontium-90 on the life span and incidence of bone tumors in mice; the effects of irradiation on xanthine concentration and xanthine oxidase activity in chicken liver homogenates; the stability under various biochemical conditions and hydrolysis of S-adenosylmethionine; the biosynthesis and use as a growth factor substitute of S-adenosylmethionine by yeast mutants; design modifications of the Coulter counter, designed for red blood cells, for use in counting and sizing bacteria; electron microscope observations on fibrillogenesis in the regenerating achilles tendon of normal, scorbutic, and recovering guinea pigs; the response of mice to conditioning doses of whole-body gamma irradiation; the incidence of thymic lymphomas in mice exposed to low-dose daily cobalt-60 gamma irradiation; the relative effectiveness of cobalt-60 gamma rays and fission neutrons for producing duodenal damage in mice; genetic factors affecting tail spotting in mice; the effect of deuterium oxide on kidney function in rats; the influence of the endocrine glands on radio-induced hyperpigmentation in mice; the protective effects of injected bone marrow against radiation injuries in mice; the biological effects of neutrons in the epithermal region from 0.1 to 100,000 ev; the effect of whole-body neutron irradiation on the volitional activity of the mouse; developments in neutron-capture therapy; development of methods for estimating the body burden for various tracer radionuclides; the recovery of irradiated amoebae following injection of non-irradiated protoplasm; tracer studies employing phosphorus-32 in determination of the life span of neutrophils; the antipyretic effects of salicylates and aurintricarboxylic acid; the use of chelating agents in the treatment of manganese poisoning; the tissue distribution and toxic effects following long-term ingestion of deuterium oxide in mice; measurements of the radioactivity of typical foodstuffs after pile irradiation for the purpose of sterilization; the production of heat by the neutron irradiation of boron-free glass, lime glass, and quartz and its effect upon the condensation of phosphate; measurement of calcium-45 by liquid scintillation methods; tracer studies of protein turnover in rat liver; the effects of dietary cholesterol on cholesterol levels and cholesterol ester composition in liver and plasma of rats; and statistical studies of bone tumor death rates, characteristics of the Argonne National Laboratory population, and inbreeding in the European bison population. (For preceding period see ANL-5732.) (C.H.)

15217 HW-53500

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

HANFORD BIOLOGY RESEARCH ANNUAL REPORT FOR 1957. Jan. 10, 1958. 227p. Contract W-31-109-Eng-52. $3.50(OTS).

Data are presented on the uptake, distribution, and turnover of radioelements in plants, animals, and communities; the biological effects of ionizing radiations on certain organs and organisms; and the effects of operations at Hanford on plant and animal life of the region. Factors that affect radiostrontium uptake and deposition in plants and animals were investigated, with special emphasis on the effects of calcium. Data are included from studies on the permissible limits for Cs^{137}; the uptake of I^{131} by plants and animals; permissible limits for plutonium in drinking water; the hazards from the deposition of radioactive particles and factors affecting their removal; the mechanisms by which ionizing radiations cause biological effects; the effects of reactor effluent on plants and animals; and measurements of the concentration of radioelements from reactor effluent absorbed by plants and animals. (For preceding period see HW-47500.) (C.H.)

15218 LA-2179

Los Alamos Scientific Lab., N. Mex.

EFFECTS OF X IRRADIATION ON CHOLESTEROL, FATTY ACID AND PROTEIN SYNTHESIS. R. Gordon

Gould, Virginia L. Bell, Edith H. Lilly, Patricia Keegan, Jean Van Ripper, and Mary Lou Jonnard. Jan. 1957. 46p. Contract W-7405-Eng-36. $1.25(OTS).

Whole-body x irradiation of rats has been shown to result in an increase in the rate of cholesterol biosynthesis in liver and adrenal glands. This has been demonstrated by determination of the incorporation of acetate-1-C^{14} both in the intact animal and in tissue slices, and by the incorporation of tritium labeled body water into cholesterol. The effect was evident 24 hours after irradiation but was much larger 48 hours after. The increase in rate in liver in intact rats was about 100% per 100 r over the range 300 to 2400 r. X irradiation decreased the cholesterol concentration by about 20% and increased the liver weight about 40%, 48 hours after irradiation. The effect on fatty acid and protein synthesis and on cholesterol biosynthesis in certain other tissues was also studied and found to be either unchanged or increased to a much smaller extent than cholesterol biosynthesis in liver and the adrenal glands. (auth)

15219 UCRL-8265

California. Univ., Berkeley. Radiation Lab.
BIOLOGY AND MEDICINE SEMIANNUAL REPORT [FOR] OCTOBER 1957 THROUGH MARCH 1958.
Apr. 25, 1958. 65p. Contract W-7405-eng-48. $1.75 (OTS).

Data are presented from the following studies: the radiation chemistry of pepsin, gelatin, methanol, benzene, and hexanes; the effects of irradiation of the pituitary in advanced cancer using high-energy particles from the 184-inch cyclotron; applications of ion beams in biological studies; the metabolism of strontium-90 and its relation to calcium metabolism in rats; hematological effects of low-level radiation doses in man; the influence of diet on serum lipoproteins; development of simplified methods for the analysis of blood serum for lipid content; tracer studies employing iron-59 of red blood cell production and destruction and iron metabolism in a wide variety of blood disorders; tracer studies on heart function and blood circulation employing I^{131}; applications of C^{14} in studies of leukocyte formation from which it was concluded that peripheral neutrophils have a 2-day life span, large lyphocytes a life span of 2 to 3 days, and small lyphocytes a life span of between 8 and 14 days; tracer studies employing P^{32} in studies of the phagocytic action of cells of the reticuloendothelial system; factors regulating the volume of the body fluids; and development of a method for determining estrogen concentration in urine. Radiation protection activities are summarized. Lists are included of reports issued and papers published during the period. (For preceding period see UCRL-8031.) (C.H.)

15220 AEC-tr-3333

SOME MECHANISMS OF THE BIOLOGICAL ACTION OF IONIZING RADIATION. G. S. Strelin. Translated for Sandia Corp. from Med. Radiol. 1, No. 1, 27-35 (1956). 12p.

Selective suppression of the processes of physiological and reparative regeneration is a characteristic feature of the biological action of ionizing radiation. This feature may be demonstrated in very diverse biological material. Lesions caused by irradiation may be clearly seen morphologically during regeneration. Radiation lesions not only appear during the process of regeneration but also disappear, and normal tissue is restored. The varying ability of tissues to repair radiation lesions is due to their inherent activity of physiological regeneration, and is determined by correlation between the sensitivity of the tissues and changes in the strength of the dose of irradiation. This conclusion is confirmed by a number of facts but cannot yet be considered completely proved. (auth)

15221 JPRS-210

VARIOUS STUDIES ON THE USE OF RADIOACTIVE SUBSTANCES IN MEDICINE. (Consists of Translation of Ten Papers.) July 1958. 117p.

Available from Photoduplication Service, Library of Congress.

Studies on the medical uses of radioactive substances include a review of lesions caused by ionizing radiations, the cancerogenic effects of radioisotopes, the clinical picture and treatment of radiation sickness, radiation hazards from environmental strontium-90, investigations of radiation effects on immunological reactions, and applications of ionizing radiations in the preparation of pharmaceuticals. (C.H.)

15222 JPRS-210(p.1-10)

GENERAL PRINCIPLES ON THE TREATMENT OF LESIONS CAUSED BY RADIOACTIVE SUBSTANCES. V. A. Sanotskii (Sanotskiy). Translated from Med. Radiol. 2, No. 5, 14-22(1957). p.1-10 [of] VARIOUS STUDIES ON THE USE OF RADIOACTIVE SUBSTANCES IN MEDICINE. 10p.

The causes, symptoms, and therapy of radiation sickness are discussed. (C.H.)

15223 JPRS-210(p.11-26)

ON THE CONSEQUENCES OF THE FALLOUT OF THE RADIOACTIVE ISOTOPE OF STRONTIUM (Sr-90). A. V. Lebdinskii (Lebdinskiy). Translated from Med. Radiol. 2, No. 5, 22-32(1957). p.11-26 [of] VARIOUS STUDIES ON THE USE OF RADIOACTIVE SUBSTANCES IN MEDICINE. 16p.

Data are reviewed on the possible consequences to mankind of environmental strontium-90 from fall-out. (C.H.)

15224 JPRS-210(p.27-34)

BLASTONOGENIC EFFECT OF RADIOACTIVE STRONTIUM. N. N. Krayevskii (Krayevskiy) and N. N. Litvinov. Translated from Med. Radiol. 2, No. 5, 33-8 (1957). p.27-34 [of] VARIOUS STUDIES ON THE USE OF RADIOACTIVE SUBSTANCES IN MEDICINE. 8p.

The properties of strontium-90 are reviewed. Data are summarized on the incidence of leukemia and bone tumors in young laboratory animals following the administration of various doses of strontium-90. (C.H.)

15225 JPRS-210(p.35-52)

RADIOACTIVE ISOTOPES AS CANCEROGENIC AGENTS. N. V. Strel'tsova and Yu. I. Moskalev. Translated from Med. Radiol. 2, No. 5, 39-51(1957). p.35-52 [of] VARIOUS STUDIES ON THE USE OF RADIOACTIVE SUBSTANCES IN MEDICINE. 18p.

A comparative analysis was made of the cancerogenic action of a number of radioisotopes administered parenterally or orally to rats and rabbits. The radioactive isotopes used included strontium-89, strontium-90, barium-140, yttrium-90, yttrium-91, cesium-127, calcium-45, niobium-95, cerium-144, promethium-147, lanthanum-140, ruthenium-106, plutonium-239. Data are tabulated on the types of lesions produced. (C.H.)

15226 JPRS-210(p.53-7)

ON REVEALING TOXIC PROPERTIES OF THE BLOOD IN IRRADIATED ANIMALS IN EXPERIMENTS ON ADRENALECTOMIZED ANIMALS. P. D. Gorizontov and S. A. Davydova. Translated from Med. Radiol. 2, No. 5, 51-5(1957). p.53-7 [of] VARIOUS STUDIES ON THE USE OF RADIOACTIVE SUBSTANCES IN MEDICINE. 5p.

Tests on adrenalectomized animals were made to appraise the role of suprarenal glands in neutralizing toxic substances developed in the blood after irradiation. Data are tabulated. (C.H.)

15227 JPRS-210(p.58-69)
CERTAIN RESULTS OF INVESTIGATION IN THE STUDY OF THE EFFECT OF IONIZING RADIATION ON INFECTION AND IMMUNITY. P. N. Kiselev. Translated from Med. Radiol. 2, No. 5, 55-64(1957). p.58-69 [of] VARIOUS STUDIES ON THE USE OF RADIOACTIVE SUBSTANCES IN MEDICINE. 11p.

A summary is presented of data on the character and nature of immunity and on the influence of immune mechanisms on the course of infection when an organism is subjected to large doses of ionizing radiation. (C.H.)

15228 JPRS-210(p.70-84)
THE EFFECT OF ACTIVE IMMUNIZATION AGAINST INTESTINAL INFECTIONS AND TUBERCULOSIS ON THE RADIORESISTANCE OF ANIMALS. N. N. Klemparskaya, V. F. Sosova, O. R. Nemirovich-Danchenko, and G. M. L'vitsina. Translated from Med. Radiol. 2, No. 5, 65-72(1957). p.70-84 [of] VARIOUS STUDIES ON THE USE OF RADIOACTIVE SUBSTANCES IN MEDICINE. 15p.

Active immunization against tuberculosis prior to exposure increased the radioresistance of laboratory animals. Other living bacteria vaccines did not produce an increase in the survival as did the tuberculosis vaccine. (C.H.)

15229 JPRS-210(p.85-93)
CLINICAL PICTURE AND TREATMENT OF CHRONIC RADIATION SICKNESS. P. M. Kireyev. Translated from Med. Radiol. 2, No. 5, 72-9(1957). p.85-93 [of] VARIOUS STUDIES ON THE USE OF RADIOACTIVE SUBSTANCES IN MEDICINE. 9p.

The clinical picture and treatment of chronic radiation sickness is reviewed. (C.H.)

15230 JPRS-210(p.94-107)
APPLICATION OF IONIZING RADIATION IN THE PRODUCTION OF BACTERIAL PREPARATIONS. V. L. Troitskii (Troitskiy). Translated from Med. Radiol. 2, No. 5, 80-8(1957). p.94-107 [of] VARIOUS STUDIES ON THE USE OF RADIOACTIVE SUBSTANCES IN MEDICINE. 14p.

Applications of radiation in the cold sterilization of bacterial preparations and pharmaceuticals are discussed. (C.H.)

15231 JPRS-210(p.108-15)
HYGIENIC EVALUATION OF RADIOACTIVE STRONTIUM AS A FACTOR IN THE CONTAMINATION OF THE EXTERNAL ENVIRONMENT. A. N. Marey. Translated from Med. Radiol. 2, No. 5, 89-95(1957). p.108-15 [of] VARIOUS STUDIES ON THE USE OF RADIOACTIVE SUBSTANCES IN MEDICINE. 8p.

Hazards for present and future generations from environmental strontium-90 are discussed. (C.H.)

15232 NIH-tr-2-37
MECHANISM OF RETARDED DEATH AFTER TOTAL BODY X-RAY EXPOSURE. (Uber den Mechanismus des verzögert eintretenden Todes nach Totalkörperbestrahlung.) Arthur C. Upton, Charles C. Congdon, and Alexander Hollaender. Translated by E. Dernay (National Institutes of Health, Bethesda, Md.) from Atompraxis 3, 1-6(1957). 18p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 11031.

15233
RADIATION EFFECTS ON BONE OF CHILDREN. Kenneth L. Krabbenhoft. Am. J. Roentgenol. Radium Therapy Nuclear Med. 80, 526-8(1958) Sept.

Data gained from observations following the administration of radiation therapy over growing sections of the skeleton are reviewed. Devitalization of osseous structures resulting in demineralization, avascularity, and subsequent fracture have been observed following administration of therapeutic doses of x radiation to immature bone. Factors to be considered in the radiation treatment of bone lesions in children are reviewed. (C.H.)

15234
X-RAY INACTIVATION OF HYALURONIDASE FROM ESCHERICHIA COLI FREUNDII AND BOVINE TESTES. Robert Brunish and Amos Norman (Univ. of California, Los Angeles). Arch. Biochem. Biophys. 76, 457-60 (1958) Aug.

The molecular weight of Escherichia coli freundii hyaluronidase has been determined to be 2.2×10^5 and that of bovine testicular hyaluronidase 7.1×10^4. The x-ray sensitivity of the bacterial enzyme was not altered during its isolation from the cell and subsequent purification. Both the bacterial and the testicular hyaluronidase behave as a single enzyme; i.e., there is no evidence of polydispersity in the inactivation curves. (auth)

15235
THE THEORY OF THE BIOLOGICAL ACTIONS OF RADIATION. A. G. Pasynskii (Bakh Inst. of Biochemistry, Academy of Sciences of the USSR, Moscow). Biophysics (USSR) (English Translation) 2, 558-63 (1958).

The conditions in which the primary radiation-inactivated volumes of molecular dimensions can disturb the steady state of the cell via changes in the diffusion parameters are elucidated from concepts in the theory of open systems. It is shown that the disturbances can occur via damage to intracellular molecular interfaces. The main problems in the primary mechanism of biological radiation effects are considered from this viewpoint. (auth)

15236
SOME REGULARITIES IN THE RETARDATION OF THE FIRST DIVISION IN YEAST CELLS ACTED ON BY ^{60}Co γ-RAYS. V. I. Korogodin (Lomonosov State Univ., Moscow). Biophysics (USSR) (English Translation) 2, 566-70(1958).

Three types of multiplication disturbance were observed in yeast cultures exposed to cobalt-60 gamma irradiation. These include reversible delay in the commencement of division, irreversible immediate inactivation, and delays in growth and budding-off. (C.H.)

15237
QUANTITATIVE ASPECTS OF THE RECOVERY PROCESSES IN ORGANISMS AFTER GENERAL IRRADIATION. E. N. Tolkacheva (Inst. of Biophysics, Academy of Sciences of the USSR, Moscow). Biophysics (USSR) (English Translation) 2, 570-7(1958).

Data are reported from studies on the recovery process after whole-body irradiation in rats. The sensitivity to a second irradiation was found to vary with the time after a first dose. (C.H.)

15238
PROPAGATION OF NON-IMPULSE EFFECTS ALONG A NERVE FROM A REGION EXPOSED TO X-IRRADIATION. M. V. Kirzon and M. G. Pshennikova (Lomonosov

State Univ., Moscow). Biophysics (USSR) (English Translation) 2, 668-79(1958).

Following irradiation of a small segment of frog nerve, the muscular responses to stimulation of the nerve at a point proximal to the irradiated part show that for a short period only a rise in excitability takes place. This is followed by a progressive loss of conductivity in the irradiated segment. The rate of development of the block is dependent on radiation dose. Stimulation in the nerve distal to the irradiated segment indicates that increased excitability develops. This process was investigated at distances of up to 25 mm from the limits of the irradiated segment. The rate with which muscular responses weakened was dependent on radiation dose and strength of stimuli applied in the distal nerve. Ideas are presented in support of the view that this weakening in muscular responses occurs as a result of a decline in the functional capacities of the neuro-muscular synapses and perhaps of the muscle itself. Changes in muscular response and the conclusions drawn from them regarding prolonged change in excitability in the distal part of the nerve, allow one to affirm that from the irradiated nerve trunk region non-impulse effects are spread which become more pronounced despite cessation of irradiation and loss of conductivity in the irradiated part. (auth)

15239

REGARDING GRAEVSKII AND KEILINA'S PAPER "REDUCED SENSITIVITY TO LETHAL DOSES OF X-RAYS IN ANIMALS PREVIOUSLY GIVEN SUBLETHAL DOSES." I. G. Krasnykh and S. P. Yarmonenko. Biophysics (USSR) (English Translation) 2, 733-4(1958).

Considerable increases in the resistance to x rays were obtained by first giving white rats and dogs non-lethal doses. The experiments are reported in detail. The importance of the standardization of irradiation conditions used with experimental animals is stressed. (C.H.)

15240

EFFECTS OF IRRADIATION ON LOCUSTA MIGRATORIA L. Pierre Joly and Genevieve Biellmann. Compt. rend. 247, 243-6(1958) July 16. (In French)

A series of experiments was performed to determine if x irradiation affected the molting of insects. The dose used was 4,700 r, half the mortal dosage for adults. The insects were irradiated at a predetermined age, counted from the beginning of the third molting. Half the insects received whole-body irradiation, and in the other half the head and prothorax were protected by a lead screen. The study showed that a dose acceptable to the adult killed the larva of Locusta migratoria. If the irradiation was done before a certain critical time, it prevented the next molting although the insect lived beyond the molting date of the controls. After the critical period, the radiation is without any effect on the next molting which is produced after a perfectly normal time period, but the radiation prevents the following moltings. (J.S.R.)

15241

HYPERSEGMENTATION OF NEUTROPHIL NUCLEI IN A WOUND EXUDATE OCCURRING UNDER THE INFLUENCE OF THE ADRENAL CORTEX HORMONE AND RADIATION. A. A. Voitkevich and A. I. Bukhonova (Voronezh Medical Inst.). Doklady Akad. Nauk S.S.S.R. 120, 914-17(1958) June 1. (In Russian)

Segmentation of neutrophiles was induced by a radio-induced increase in the concentration of adrenal hormones and by cortisone. Data confirmed the assumption that the hypersegmentation of neutrophil nuclei is an external phenomenon of physiological displacement in the cell and is an indicator of intensified metabolism unfavorably affecting the organism. (R.V.J.)

15242

CONDITIONED REFLEXES IN DOGS SUBJECTED TO LOCAL β-IRRADIATION OF STRICTLY LIMITED AREAS OF THEIR SKIN OR MUCOUS MEMBRANE. I. M. Gorbunova and N. A. Rokotova (Pavlov Inst. of Physiology, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 120, 922-5(1958) June 1. (In Russian)

Beta irradiation in doses of 2 r affects the tissue and mucous membrane receptors and alters the conditioned reflexes. The conditioned reflexes outside the direct irradiation periphery are also affected due to the changes in reflexes of the irradiated area. (R.V.J.)

15243

CHANGES IN THE ALKALINE BLOOD RESERVE IN ANIMALS SUFFERING FROM ACUTE RADIATION DISEASE. L. N. Marich (Central Research Inst. of Roentgen-Radiology, Leningrad). Doklady Akad. Nauk S.S.S.R. 120, 1003-6(1958) June 11. (In Russian)

Gradual changes in acid-alkaline equilibrium in acute radiation sickness of rabbits were studied. After total body exposure to lethal and sublethal doses of x radiation, the blood alkaline reserve dropped twice, first after 2 hr, and again before death. With exposure to 400 and 700 r, the blood alkaline reserve drops after 4 hr following the exposure. The changes in alkaline reserve can be applied in early diagnosis of radiation injuries. (R.V.J.)

15244

THE ROLE OF CONSTITUTIONAL (HEREDITARY) PECULIAR TRAITS IN THE RADIOSENSITIVITY OF ANIMALS. N. I. Nuzhdin, N. I. Shapiro, and I. A. Nechaev (Inst. of Genetics, Academy of Sciencies, USSR). Doklady Akad. Nauk S.S.S.R. 120, 1126-8(1958) June 11. (In Russian)

Data are presented on variations in the radiosensitivity of various strains of mice. The regularities in responses of identical strain mice are discussed. (R.V.J.)

15245

ON THE INCREASE IN THE INJURIOUS EFFECT OF X-RAYS UPON THE DEVELOPMENT OF EMBRYOS, AS A RESULT OF UTERUS DENERVATION AND OPERATION SHOCK. N. A. Samoshkina (Inst. of Experimental Medicine, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 120, 1249-52(1958) June 21. (In Russian)

Uterus denervation before pregnancy with the exposure to 60 r on the 4th day after pregnancy and under the same conditions to 200 r showed that with pregnancy occurring after 1 to 3 months the development of the embryo is not affected by denervation. Obviously the damage done by instruments corrected itself. Uterus denervation without irradiation results in serious disturbance in the implantation and reduces the number of normally developed embryos to 57%. Exposure to 200 r on the fourth day of pregnancy resulted in 40% normally developing embryos and 60% with various abnormalities; most of them perished. Uterus denervation on the 1st day of pregnancy with exposure to 200 r irradiation resulted in only 27% normally developing embryos. (R.V.J.)

15246

FACTORS LIMITING THE NUMBER OF RADIATION-INDUCED CHROMOSOME EXCHANGES. I. DISTANCE:

EVIDENCE FROM NON-INTERACTION OF X-RAY- AND NEUTRON-INDUCED BREAKS. Sheldon Wolff, K. C. Atwood, M. L. Randolph, and H. E. Luippold (Oak Ridge National Lab., Tenn.). J. Biophys. Biochem. Cytol. 4, 365-72(1958) July.

Soaked seeds of Vicia faba were exposed to fractionated doses of x rays or x rays and fast neutrons. When the two-hit (exchange) chromosome aberrations were scored at the first mitosis of the root tip, it was observed that with short fractionation times the radiation-induced breaks from the two x-ray doses could rejoin with one another to form exchanges in proportion to the square of the total dose. If, however, one dose was x rays and the second neutrons, then no quantitatively determinable interaction occurred between the breaks induced by each of the doses, and the aberration yield was simply the sum of that induced by each fraction. The phenomenon of non-interaction as observed by these dose fractionation studies and also by the linear dose response curve for two-break aberrations induced by neutrons has led to calculations of the distance over which two breaks can rejoin. The distance is evidently much smaller than the previously accepted value of 1 μ. (auth)

15247

POTASSIUM LOSS OF COLD BLOODED MUSCLES AFTER X IRRADIATION. H. D. Bergeder (Univ. of Bonn). Naturwissenschaften 45, 61(1958). (In German)

An investigation was made using frog muscles to determine how much radiation would affect the diffusion velocity of K ions from the muscle tissues into a K free medium. The sartorius muscle was prepared in the usual manner, weighed, measured, and placed in K free Ringer's solution with oxygen bubbling through it. At the end of 10 min, 60 min, and hourly intervals thereafter, the solution was changed, the muscle measured, and the K content of the solution determined. In parallel tests, the muscles were irradiated with between 50 and 300 kr radiation. The results showed that x irradiation increases the K loss to the solution. (J.S.R.)

15248

STUDIES ON A RADIATION-RESISTANT PIGMENTED SARCINA sp. R. E. Kilburn, W. D. Bellamy, and S. A. Terni (General Electric Research Lab., Schenectady, N. Y.). Radiation Research 9, 207-15(1958) Aug.

An attempt is made to relate the radiation resistance of a strain of Sarcina to its carotenoid pigment content. (C.H.)

15249

PHYSICOCHEMICAL EFFECTS OF RADIATION. III. EFFECTS OF HIGH-SPEED ELECTRONS ON BOVINE FIBRINOGEN AS REVEALED BY THE ULTRACENTRIFUGE AND VISCOSITY. Raymond Sowinski, Lubomyra Oharenko, and Virgil L. Koenig (Northwestern Univ. Medical School, Chicago). Radiation Research 9, 229-39(1958) Aug.

Bovine fibrinogen subjected to high-speed electron irradiation in the dry state and then dissolved in 0.5 N NaCl showed marked progressive changes in sedimentation and viscosity properties. (auth)

15250

EFFECT OF X-RAYS ON Fe^{59}-LABELED GRANULOCYTES AND LYMPHOCYTES OF THE RABBIT. Luigi Resegotti (Univ. of Stockholm). Radiation Research 9, 240-7(1958) Aug.

The effect of 200 r of x-irradiation on the incorporation of Fe^{59}-labeled plasma iron into the hemins of leukocytes of the rabbit was investigated. The specific activity of granulocyte hemin iron decreased under the effect of x-ray exposure, but the number of these cells remained unaltered. This result indicates an inhibition of myelopoiesis by irradiation. The number of lymphocytes in the circulation decreases under the effect of irradiation, whereas the specific activity of their hemin iron remains constant. This observation suggests that old nonlabeled and new labeled lymphocytes are affected to the same extent by irradiation. During the first day, however, the specific activity of lymphocyte hemin iron is higher in the exposed animals than in the controls, which masks the effect of irradiation on lymphocyte hemin formation. (auth)

15251

THE OBSERVATION OF TWO-PROCESS SURVIVAL CURVES IN GAMMA-IRRADIATED NEUROSPORA CONIDIA. Robert D. Gafford (USAF, Randolph Air Force Base, Texas). Radiation Research 9, 248-59 (1958) Aug.

Neurospora conidia irradiated by Co^{60} γ-rays in aqueous suspension under aerobic conditions exhibit survival curves that indicate the occurrence of two different inactivation processes. The more effective process is an indirect process that requires the presence of water and oxygen and results in nuclear inactivation. The second process is a direct-hit process that cannot be definitely associated with any particular cellular component. Only this second process is effective in killing spores irradiated in the lyophilized state. (auth)

15252

THE EFFECT OF IONIZING RADIATION ON THE MACROMOLECULAR COMPOSITION OF THYMUS. Eugene L. Hess and Saima E. Lagg (Worcester Foundation for Experimental Biology, Shrewsbury, Mass.). Radiation Research 9, 260-9(1958) Aug.

Extracts of thymus from rabbits and calves exposed to whole-body ionizing radiation have been analyzed spectrophotometrically, electrophoretically, and in terms of nucleic acid and lipid content. Striking differences which were a function of time and dosage were found when the results were compared with those from similar extracts of thymus from untreated animals. (auth)

15253

THE RELATIVE BIOLOGICAL EFFECTIVENESS OF 4-Mev AND 200-Kvp X-RAYS, DETERMINED BY THE LD_{50} OF THE 4-DAY-OLD CHICK EMBRYO. Robert F. Kallman, Roderic E. Steele, Mitchel Weissbluth, and Malcolm A. Bagshaw (Stanford Univ. School of Medicine, San Francisco). Radiation Research 9, 270-7(1958) Aug.

The relative biological effectiveness, η, of 4-Mev x rays compared with 200-kvp x rays was determined from the dose-survival curve for the 4-day-old chick embryo. Survival was judged by the number of embryos showing heartbeat 7 hours after irradiation. Ionization measurements at 200 kvp were converted to rads. Ionization measurements at 4 Mev were converted to rads by means of factors supplied by the ferrous sulfate dosimeter. The value of η (absorbed dose) was 0.90 ± 0.03. (auth)

15254

THE RELATIVE BIOLOGICAL EFFECTIVENESS OF FAST NEUTRONS AND X-RAYS FOR LIFE SHORTENING IN MICE. H. J. Curtis and Katharine Gebhard (Brookhaven National Lab., Upton, N. Y.). Radiation Research 9, 278-84(1958) Aug.

The relative biological effectiveness (RBE) of fast neutrons versus x rays has been measured for the shortening of the life span in mice. Three experiments were performed comparing these two radiations, and in each the ratio of x rays to neutrons was such as to produce the same 30-day mortality. The first experiment employed large single doses of the radiations; the second, four smaller doses at 7-day intervals; and the third, four smaller doses at 14-day intervals. All animals were kept until natural death. The RBE was found to be the same (1.7) for acute lethal effects as for shortening of life span in all three experiments. The animals receiving neutron treatments did not gain weight as fast as the x-ray-treated animals, however. In view of previously reported high values of RBE for chronic neutron versus x irradiation, it is concluded that the relative recovery rates for neutrons versus x rays are different for small doses from those for large doses. (auth)

15255

EFFECTS OF X-IRRADIATION ON TRACE ELEMENT LEVELS IN RAT TISSUES. George E. Heggen, Kenneth B. Olson, Carl F. Edwards, Leonard B. Clark, and Marilyn Maisel (Saratoga Springs Commission Research Labs., N. Y.; Albany Medical Coll., N. Y.; and Union Coll., Schenectady, N. Y.). Radiation Research 9, 285-90(1958) Aug.

Fourteen trace elements have been studied in the liver, spleen, kidney, and lungs of rats after they had received 600 r total-body irradiation. Iron, zinc, copper, molybdenum, and manganese were found consistently, and certain of these elements showed marked variation in concentration and total organ content at intervals of 2 to 12 days after irradiation. (auth)

15256

LIFE-SHORTENING BY WHOLE- AND PARTIAL-BODY X-IRRADIATION IN MICE. Robert F. Kallman and Henry I. Kohn (Univ. of California School of Medicine, San Francisco). Science 128, 301-2(1958) Aug. 8.

Data are presented from studies on mice which indicate how varied the life-shortening effects of partial- and whole-body exposure can be and the difficulties in attempting to extrapolate from one to the other. They also indicate how tenuous the quantitative estimates of life shortening in man must be when they are based on the relatively incomplete data currently available for experimental animals. (C.H.)

15257

THE EFFECT OF X RADIATION ON THE HEALING PROCESS. Heinz Baron and Heinz Vieten (Medizinischen Akademie, Düsseldorf). Strahlentherapie 106, 354-63(1958). (In German)

High doses of x radiation distrubed the normal healing of wounds inflicted in guinea pigs. Low dose of x radiation had little or no adverse effect on wound healing. Irradiations administered 4 weeks before wounds were inflicted disturbed healing, even when small doses were used. (C.H.)

15258

THE EFFECT OF FRACTIONED X RADIATION ON THE SPINAL CORD IN ANIMALS. Alfred Breit (Stadtischen Krankenhauses, Passau, Germany). Strahlentherapie 106, 446-50(1958). (In German)

Histological examination of cross sections of spinal cord following exposure to therapeutic doses of x radiation administered by the fractionation technique indicates that distinct modifications in the spinal marrow are induced by therapeutic dosage levels. (C.H.)

15259

THE DENATURIZATION OF PROTEIN SERUM BY X RADIATION. Hermann Engelhard, Hagen Bülow, and Eric Canel (Univ. of Göttingen, Germany). Z. Naturforsch. 13b, 413-20(1958) July. (In German)

Investigations on the denaturization of protein serum made possible the following explanations. The absorption of the radiation energy occurs when in a finite volume a protein particle and a primary ionization are present simultaneously. In the energy absorption, secondary reactions appear according to the kind of surrounding medium. (tr-auth)

15260

ACTION OF RADIATION ON TISSUES. An Introduction to Radiotherapy. A. Lacassagne and G. Gricouroff. New York, Grune & Stratton, Inc., 1958. 207p.

An attempt is made to delineate and interpret the changes induced by the action of radiation on tissues. (C.H.)

15261

METHODS FOR THE DETECTION AND ENUMERATION OF MUTATIONS PRODUCED BY IRRADIATION IN MICE. J. B. S. Haldane (Indian Statistical Inst., Calcutta). pp. 35-9 in "Proceedings of the International Genetics Symposia, 1956, Tokyo & Kyoto, September, 1956". Tokyo, International Genetics Symposia, 1956, Science Council of Japan, 1957. 702p.

Eight types of study are outlined in which mice may be used in studies of radioinduced mutations. One method is recommended for the assessment of radiation effects on future human generations. (C.H.)

15262

STUDIES ON THE POTENTIAL GENETIC EFFECTS OF THE ATOMIC BOMBS. James V. Neel and William J. Schull (Univ. of Michigan, Ann Arbor). pp. 57-69 in "Proceedings of the International Genetics Symposia, 1956, Tokyo & Kyoto, September, 1956". Tokyo, International Genetics Symposia, 1956, Science Council of Japan, 1957. 702p.

Data are summarized from a survey on genetic effects of radiation observed on the offspring when one or both parents were exposed to radiation from the atomic bombings of Hiroshima and Nagasaki. (C.H.)

15263

CONSEQUENCES OF RADIATION-INDUCED CHROMOSOME BREAKAGE IN DROSOPHILA SPERM. William K. Baker (Univ. of Chicago and Oak Ridge National Lab., Tenn.). pp. 235-8 in "Proceedings of the International Genetics Symposia, 1956, Tokyo & Kyoto, September, 1956". Tokyo, International Genetics Symposia, 1956, Science Council of Japan, 1957. 702p.

Experiments are described which were designed to measure three criteria of radioinduced chromosome breakage. These criteria were measured on three types of Drosophila sex chromosomes. Correct interpretation of experiments using ring chromosomes are discussed. (C.H.)

15264

CHROMOSOME ABERRATIONS AND PHYSIOLOGICAL EFFECTS OF X RADIATION IN TRADESCANTIA MICROSPORES. Alvin V. Beatty (Emory Univ., Georgia). pp. 239-42 in "Proceedings of the International Genetics Symposia, 1956, Tokyo & Kyoto, September, 1956". Tokyo, International Genetics Symposia, 1956, Science Council of Japan, 1957. 702p.

Factors affecting the production of radioinduced chromosome aberrations in Tradescantia microspores are discussed. (C.H.)

15265

RADIOSENSITIVITY STUDIES IN PEANUTS (ARACHIS HYPOGAEA L.). Walton C. Gregory (North Carolina State Coll., Raleigh). pp. 243-7 in "Proceedings of the International Genetics Symposia, 1956, Tokyo & Kyoto, September, 1956". Tokyo, International Genetics Symposia, 1956, Science Council of Japan, 1957. 702p.

From the data presented it appears that differences in radiosensitivity to x rays among certain lines of peanuts do not appear in the same manner when the same lines are treated with fast neutrons. However, differences in sensitivity to neutrons appearing among the lines and their hybrids suggest a qualitatively different behavior of the lines and hybrids with respect to x rays and neutrons. Evidence for the association of genotype with radiosensitivity can be derived from both x ray and neutron treatments with different genotypes responding different ways to the two radiations. (auth)

15266

TRANSLOCATION OF A PIECE OF AN AUTOSOME TO THE W CHROMOSOME, AND INDUCTION OF A DOMINANT LETHAL FACTOR IN THE SILKWORM BY X-RAYS. Haruo Hasimoto (Ministry of Agriculture and Forestry, Matumoto, Japan). pp. 248-51 in "Proceedings of the International Genetics Symposia, 1956, Tokyo & Kyoto, September, 1956". Tokyo, International Genetics Symposia, 1956, Science Council of Japan, 1957. 702p.

The translocation induced by chromosome irradiation is probably a reciprocal interchange involving the W chromosome and a Zebra-lemon autosome, where a W chromosome segment bearing the female-determining factor is combined with a segment bearing the Zebra gene, while the rest of the W chromosome is united with the part of the autosome bearing the lemon locus. The lemon locus-bearing segment apparently carries the lethal factor in question. In ordinary circumstances the W chromosome is transmitted in the female line, but when the segment enters a male as in the present case, it produces a lethal effect. Therefore, it may be concluded that the W chromosome has a regional differentiation, and the female-determining factor occupies a certain restricted region of the chromosome, while the other region has a lethal effect for the male which carries it. (auth)

15267

AFTER EFFECT OF IRRADIATION OF THE GERM CELL OF DROSOPHILA MELANOGASTER. Kôiti Murati, Takashi Ito, Daigoro Moriwaki, and Yukihiro Yoshida (St. Paul's Univ., Tokyo and Tokyo Metropolitan Univ.). pp. 256-9 in "Proceedings of the International Genetics Symposia, 1956, Tokyo & Kyoto, September, 1956". Tokyo, International Genetics Symposia, 1956, Science Council of Japan, 1957. 702p.

Data are tabulated from a series of studies on the effect of irradiation on the germ cell of Drosophila. (C.H.)

15268

DIFFERENCES BETWEEN MALE AND FEMALE TREATMENTS IN VISIBLE X-RAY INDUCED MUTATION RATES IN THE SILKWORM. Yoshio Nakao (Kyoto Prefectural Medical Coll.). pp. 260-4 in "Proceedings of the International Genetics Symposia, 1956, Tokyo & Kyoto, September, 1956". Tokyo, International Genetics Symposia, 1956, Science Council of Japan, 1957. 702p.

A study was made of the pattern of the mutation rates of x-irradiated male and female silkworms exposed at two loci along the same chromosome. Data are tabulated. (C.H.)

15269

GENETIC AND CYTOLOGICAL STUDIES ON THE PROGENY OF RICE PLANTS EXPOSED TO THE ATOMIC BOMB AS WELL AS OF THOSE IRRADIATED BY X-RAYS. Yonehachi Nishimura (National Inst. of Agricultural Sciences, Hiratsuka, Japan). pp. 265-70 in "Proceedings of the International Genetics Symposia, 1956, Tokyo & Kyoto, September, 1956". Tokyo, International Genetics Symposia, 1956, Science Council of Japan, 1957. 702p.

Rice seeds were gathered in the autumn of 1945 from paddy fields near the epicenter of the atomic bomb explosion at Nagasaki. The fields were situated about 600 to 2,000 meters from the center of the explosion. In 1946 the seeds were sown and transplanted into five plots representing various distances from the center of the explosion. At the ripening stage the plants with morphological changes or decreased fertility were counted in the field. Crosses were made in more than 100 combinations, including plants subjected to x-ray treatment. Data are tabulated on morphology and sterility of the plants. Comparison is made with data on plants grown from seed exposed to x-ray doses of 10,000 to 20,000 r under both wet and dry conditions.

15270

DIFFERENCES IN SENSITIVITY OF GERM-CELLS AND CHROMOSOMES TO RADIATION AMONG SOME MUTANT STRAINS OF THE SILKWORM. Yataro Tazima (Silk Science Research Inst., Tokyo). pp. 280-6 in "Proceedings of the International Genetics Symposia, 1956, Tokyo & Kyoto, September, 1956". Tokyo, International Genetics Symposia, 1956, Science Council of Japan, 1957. 702p.

A strain difference was found in the radiosensitivity of silkworms. (C.H.)

15271

X-RAY INDUCED MUTATIONS IN EINKORN WHEATS WITH SPECIAL REFERENCE TO THEIR COMPLEX NATURE. K. Yamashita (Kyoto Univ.). pp. 287-9 in "Proceedings of the International Genetics Symposia, 1956, Tokyo & Kyoto, September, 1956". Tokyo, International Genetics Symposia, 1956, Science Council of Japan, 1957. 702p.

Results from studies on two species of wheats indicate that the species differences observed regarding sensitivity to x radiation are controlled by genetic factors. (C.H.)

Radiation Hazards and Protection

Refer also to abstracts 15223, 15224, 15228, 15231, and 16043.

15272 K-1380

Oak Ridge Gaseous Diffusion Plant, Tenn.

STUDIES IN NUCLEAR SAFETY. Lectures Presented at the Nuclear Safety Training School Conducted by Union Carbide Nuclear Company, June 3-14, 1957. Aug. 14, 1958. 162p. Contract W-7405-eng-26. $3.00(OTS).

A compilation of the material presented at the first Nuclear Safety Training School is given. No attempt is made to present new information, but a review and summary of information applicable to nuclear safety in industry. A bibliography of publications in the field is included (51 references). Separate abstracts have been prepared for each paper. (T.R.H.)

15273 K-1380(Pt.A)
Oak Ridge Gaseous Diffusion Plant, Tenn.
BASIC PRINCIPLES OF NUCLEAR SAFETY—SUBCRITICAL SYSTEMS. H. F. Henry. Pt. A [of] STUDIES IN NUCLEAR SAFETY. Lectures Presented at the Nuclear Safety Training School Conducted by Union Carbide Nuclear Company, June 3-14, 1957. 33p. Contract W-7405-eng-26.

In this general discussion of the problem of nuclear safety as it applies to normally subcritical systems, attempts have been made to emphasize the following basic points of general applicability: The potential hazard from an accidental chain reaction has been such that facilities where it is a problem have considered it necessary to take rather stringent steps to prevent the occurrence of such an accident. The problem of nuclear safety is amenable to the standard safety-type methods of control with obvious attention to special technical requirements which are somewhat more difficult of solution than are many types of safety problems. Where practicable, operations involving fissionable materials are conducted in equipment or other wise under conditions where accidental criticality is virtually impossible and as little dependence as feasible is placed upon routine personnel actions; in general, it is maintained as a principle that no accident is possible without the simultaneous occurrence of at least two un-likely and independent events. (auth)

15274 K-1380(Pt.D)
Oak Ridge National Lab., Tenn.
CRITICAL EXPERIMENTS IN THE NUCLEAR SAFETY PROGRAM. A. D. Callihan. Pt. D [of] STUDIES IN NUCLEAR SAFETY. Lectures Presented at the Nuclear Safety Training School Conducted by Union Carbide Nuclear Company, June 3-14, 1957. 8p. Contract W-7405-eng-26.

Some of the requirements and procedures for the performance of critical experiments are discussed. (T.R.H.)

15275 K-1380(Pt.E)
Oak Ridge National Lab., Tenn.
THE FUNDAMENTALS OF CRITICALITY. R. K. Osborn. Pt. E [of] STUDIES IN NUCLEAR SAFETY. Lectures Presented at the Nuclear Safety Training School Conducted by Union Carbide Nuclear Company, June 3-14, 1957. 23p. Contract W-7405-eng-26.

The basic considerations in determining criticality are outlined. Fundamentals of nuclear properties, neutron-nuclear interactions, the criticality conditions, and heterogeneous systems are discussed. (T.R.H.)

15276 K-1380(Pt.F)
Oak Ridge National Lab., Tenn.
CRITICAL MASS DATA APPLICABLE TO NUCLEAR SAFETY PROBLEMS. R. Gwin and J. T. Thomas. Pt. F [of] STUDIES IN NUCLEAR SAFETY. Lectures Presented at the Nuclear Safety Training School Conducted by Union Carbide Nuclear Company, June 3-14, 1957. 19p. Contract W-7405-eng-26.

Representative data obtained at several laboratories are summarized graphically. These include homogeneous solutions, solids, effects of reflectors, and mention of preliminary information on interacting systems. (auth)

15277 K-1380(Pt.G)
Oak Ridge National Lab., Tenn.
THE EFFECTS OF HETEROGENEITY IN MULTIPLYING SYSTEMS. E. G. Silver. Pt. G [of] STUDIES IN NUCLEAR SAFETY. Lectures Presented at the Nuclear Safety Training School Conducted by Union Carbide Nuclear Company, June 3-14, 1957. 31p. Contract W-7405-eng-26.

The effects of heterogeneous distribution of the materials in multiplying systems are discussed. (T.R.H.)

15278 K-1380(Pt.H)
Oak Ridge Gaseous Diffusion Plant, Tenn.
INTERACTION CRITERIA. J. R. Knight. Pt. H [of] STUDIES IN NUCLEAR SAFETY. Lectures Presented at the Nuclear Safety Training School Conducted by Union Carbide Nuclear Company, June 3-14, 1957. 11p. Contract W-7405-eng-26.

A method of finding the safe conditions of spacing of individual reactors under various conditions of reflection, geometry, and reactor contents is discussed. The results of this discussion, and of the experiments that have been evaluated, lead to a simple safety curve involving only the multiplication factor of an isolated container and the solid angle between separated units. All the results indicate that this safety requirement is adequate for any amount of reflection, or any differences of geometry, assay, and moderation that may be encountered. (auth)

15279 K-1380(Pt.I)
Oak Ridge Gaseous Diffusion Plant, Tenn.
INTERACTION PROBLEMS. C. E. Newlon. Pt. I [of] STUDIES IN NUCLEAR SAFETY. Lectures Presented at the Nuclear Safety Training School Conducted by Union Carbide Nuclear Company, June 3-14, 1957. 19p. Contract W-7405-eng-26.

Introductory interaction problems, which cover the calculation of both the solid angle, and the multiplication factor have been presented together with their methods of solution according to interaction criteria currently in effect at the Oak Ridge Gaseous Diffusion Plant (ORGDP). (auth)

15280 K-1380(Pt.J)
Oak Ridge National Lab., Tenn.
NUCLEAR ACCIDENTS. A. D. Callihan. Pt. J [of] STUDIES IN NUCLEAR SAFETY. Lectures Presented at the Nuclear Safety Training School Conducted by Union Carbide Nuclear Company, June 3-14, 1957. 2p. Contract W-7405-eng-26.

Nuclear accidents at Los Alamos, Argonne, and Oak Ridge are briefly discussed. (T.R.H.)

15281 NP-6734
Chicago. Univ. Air Force Radiation Lab.
QUARTERLY PROGRESS REPORT NO. 27. Apr. 15, 1958. 145p. Contract AF41(657)-25.

A new group of 2-aminoethylisothiourea (AET) derivatives were synthesized for biological screening in an effort to discover related substances with greater radiation protective activity than AET. Fifty-three chemical compounds were tested for protective activity against mortality and weight loss in mice exposed to lethal doses of x radiation. Nineteen of the compounds exhibited significant radioprotective effects. The most marked protective effects were obtained following the pre-radiation administration of 2-aminopropylisothiuronium sulfate. Measurements were made on the mortality, body weight, and ocular changes during the first year following chronic exposure of mice to low doses of gamma and fast neutron irradiation. Data are presented from a study on the effects of AET on carbohydrate metabolism in rats and other mammalian species, and the effects of the compound on purified sulfhydryl enzymes. (For preceding period see NP-6639.) (C.H.)

15282 NP-6899
Chicago. Univ. Air Force Radiation Lab.
QUARTERLY PROGRESS REPORT NO. 28. July 15, 1958. 172p. Contract AF41(657)-25.

Seventy-four chemical compounds were tested for protective activity against mortality and weight loss in mice exposed to lethal doses of x irradiation. A group of nitrile derivatives exhibited marked protective effects. Measurements were made on the mortality, body weight, and ocular changes during 15 to 19 months after initial exposure of mice to chronic fractionated low level doses of gamma and fast neutron irradiation. Mice irradiated in a magnetic field showed longer survival times and less weight loss than control irradiated animals. The effect of quanidinoethyldisulfide (GED), the oxidized or disulfide form of 2-aminoethylisothiuronium (AET), was tested on various enzymes in vitro. The results of these experiments indicated that oxidation of AET to the disulfide form represents detoxification of the compound with respect to its action on succinic and malic dehydrogenase and cytochrome oxidase whereas the oxidation of alpha-keto acids was inhibited to approximately the same extent by the oxidized and reduced forms of AET. Results are also reported from tests on the effects of a number of sulfur-containing compounds on alpha-keto acid oxidation. Increases in the blood glucose concentrations of alloxan-diabetic rats were produced in a dose-dependent manner following the administration of 100 to 250 mgm/kgm of AET. Some of the mechanisms which may be responsible for these effects are discussed. Results are reported from preliminary studies on the ability of the liver, spleen, thymus, and bone marrow of rats exposed to sublethal and lethal doses of x irradiation to synthesize citric acid in vitro and the effects of AET on citrate synthesis in these tissues. (For preceding period see NP-6734.) (C.H.)

15283 RISÖ-3

Denmark. Atomenergikommissionen. Forsøgsinstitut, Risø.

ENVIRONMENTAL RADIOACTIVITY AT RISÖ, APRIL 1, 1957–MARCH 31, 1958. A. Aarkrog and J. Lippert. June 1958. 110p.

Measurements were made of the background radioactivity in the Risø Area during the period from April 1957 to April 1958. The measurements included determination of the total β-activity and, in the case of some samples, also the excess β-activity found after the substraction of the natural potassium activity. Measurements were made on samples of sea water, soil, air, aquatic animals, sea plants, land vegetation, surface water, rain water, and milk. No change from the background radioactivity of the previous year was observed. Fall-out radioactivity from weapons tests was determined. Data are tabulated and presented graphically. (For preceding period see NP-6692.) (C.H.)

15284 Y-1234

Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn.

ACCIDENTAL RADIATION EXCURSION AT THE Y-12 PLANT JUNE 16, 1958. Final Report. July 28, 1958. 119p. Contract W-7405-eng-26. $2.75(OTS).

The radiation accident which occurred at the Y-12 Plant on June 16, 1958, is discussed. To the extent that information is available, it describes the circumstances leading to the accident, attempts to reconstruct the nuclear reactivity conditions, and reviews the dosimetric means and results which were used to help determine the exposure of affected employees. (auth)

15285 NP-tr-125

NATURAL RADIOACTIVITY IN GROUND, WATER AND AIR. H. Israël. Translated for U.K.A.E.A., Atomic Energy Research Establishment from Beitr. Physik Atmosphäre 30, 177-88(1958). 20p. (Figures omitted).

A survey of the distribution of the natural radioactive matter in the ground, the water and the air, especially of its circulation from the exhalation from the ground via its course through the atmosphere back to the ground. From the height distribution of this matter in the atmosphere, the amount of the alpha, beta, and gamma radiation at the different heights is computed. Experience on the natural radioactivity in and above the oceans suggests that there is a surplus amount of radon in the sea water which makes it probable that there is a radon current in the upward direction rising from the bottom of the oceans. Its magnitude can be estimated as being about 0.5×10^{-18} curie/cm^2/sec. The radon exchange of the ocean with the air is given by a "pseudo-diffusion-coefficient" of the order of 200 cm^2/day. (auth)

15286

NUCLEAR INSURANCE AND STANDARDS. R. G. McAllister (Liberty Mutual Insurance Co., Hopkinton, Mass.). Am. Ind. Hyg. Assoc. J. 19, 345-8(1958) Aug.

The need for standardization in such aspects of radiation protection as dosimetry and monitoring methods, reporting of surveys, keeping of records, and waste disposal is stressed. Problems encountered when industry started to examine its potential liabilities in connection with construction and operation of nuclear reactors are discussed. (C.H.)

15287

THE MIGRATION MECHANISM OF RADIATION PROTECTION. L. Kh. Eidus, M. B. Kalamkarova, and G. K. Otarova (Inst. of Biophysics, Academy of Sciences of the USSR, Moscow). Biophysics (USSR) (English Translation) 2, 564-6(1958).

An hypothesis concerning the primary mechanism of the biological action of radiation is presented. The energy absorbed either directly or indirectly on irradiation is assumed to damage the system in the course of migrating either within or between the protein or other macromolecules. Some of the damage responsible for the physio-chemical radiation after-effects is retained in the macromolecules as long-lived electronically excited states. It does not escape and in time produces additional effects. It is suggested that this damage can be removed by intermolecular energy migration to some protective agent which forms a complex with the macromolecules. (C.H.)

15288

PROTECTIVE EFFECTS OF AZOIC THYMOLICS ON THE MORTALITY OF X-IRRADIATED MICE. J. F. Duplan, R. Royer, and R. Michelet (Laboratoire Pasteur de l'Institut du Radium). Compt. rend. soc. biol. 151, 1655-7(1957) Oct. (In French)

Male and female mice, at least 100 days old, were injected peritoneally 8 to 10 minutes before x irradiation with (dimethyl-2,5 pyrryl)-4 thymol, benzene azo-4 thymol, dibenzene azo-2,4 thymol, or benzene azo-2 methyl-4 thymol. The results are tabulated, and all show some protective effects. A possible mechanism for the protection is discussed. (J.S.R.)

15289

RADIOPROTECTIVE PROPERTIES OF CYSTAMINE FOR THE YOUNG RAT AND CHICKEN. M. L. Beaumariage (Univ. of Liege). Compt. rend. soc. biol. 151, 1788-91(1957) Oct. (In French)

The behavior of young rats and chickens of the same age submitted to a minimum 100% lethal radiation with a dose of 100 r/min is very different. The deaths occur mostly in the first 48 hours in the chicken; in the rat it does not occur until the 6th day. Cystamine protects

rats against the lethal effects of x rays, but it accelerates the death of the irradiated chickens. (J.S.R.)

15290

MALFORMATIONS OBTAINED IN EMBRYOS BY USING P^{32}. Yoshiro Kameyama (Univ. of Nagoya, Japan). Compt. rend. soc. biol. 151, 1803-4(1957) Oct. (In French)

From 2 to 20 μc/g of P^{32} were injected into pregnant mice on the 8th day of gestation. The embryos were examined after 5 days on the 13th day of gestation. The embryos were dead in all the mice receiving 20 μc/g. With doses from 2 to 15 μc/g, there was an abnormal formation in 10 to 20%, but the doses of 3 to 6 μc/g chiefly excited the malformation. The malformation was in the central nervous system. Even embryos with a natural exterior had malformations in the central nervous system. (J.S.R.)

15291

RADIOACTIVITY OF THE ATMOSPHERE. H. Garrigue (L'Université de Paris). Ind. Atom. 2, No. 7-8, 125-31 (1958). (In French)

The radioactivity of the atmosphere has been studied by many methods. The equipment used in the airplanes for the detection and measurement of radioactivity is described. The results of the measurements made since 1946 show that the artificial radioactivity has increased by approximately 100. (J.S.R.)

15292

PROPOSAL OF AN EXPRESSION OF THE RELATIVE DANGER OR RISK "H" OF A RADIOISOTOPE AND OF THE DANGER OR RISK CORRESPONDING TO A RADIOACTIVITY "r" EMITTED BY THIS RADIOISOTOPE. Pierre-Octave Robert. J. phys. radium 19 Suppl. No. 7, 117A-19A(1958) July. (In French)

The expressions $H = k_1a/M.P.I.$ (μc) or $H = k_2/M.P.I.$ (mg) are proposed for the relative risk or danger, and for the danger or risk corresponding to a radioactivity r emitted, the expressions $H' = k'_1ar/M.P.I.$ (μc) or $H' = k'_2r/M.P.I.$ (mg) are proposed, where a is the "specific activity" or "mass activity" expressed in mc/mg, r is the radioactivity expressed in mc, and k_1 and k_2 are constants expressed in mg/mc. (J.S.R.)

15293

DECONTAMINATION OF AVIATION MATERIEL. A. Akopov and A. Popov. Kryl'ya rodiny No. 1, 31(1958). (In Russian)

Modern warfare may expose aviation materiel to the action of radioactive substances. While this may not affect the quality of the materiel or the flying capacity of airplanes, heavy contamination presents a threat to peoples' lives. It is therefore imperative to decontaminate combat materiel and remove radioactive substances and dust from surfaces as soon as possible. Not all decontamination agents are suitable for aviation materiel, some being harmful to aircraft alloys or other surfaces. Decontamination methods depend upon the type of contamination, the availability of certain facilities, weather conditions, and the season. Decontamination may be carried out on a complete scale or partially; in the latter case complete decontamination of the plane must follow at the first opportunity. A discussion is presented on methods and procedures used in decontaminating a plane, the need for protective clothing and warning signs, and the importance of closing off the contaminated area. It is also recommended that planes be protected with canvas covers or other available material (grass, straw, brush), and that cockpit canopies, doors, and portholes be kept closed. Optical instruments, radio communication, and electrical equipment should be safeguarded from radioactive contamination in every way possible. (TCO)

15294

CONCERNING THE ORGANIZATION OF DECONTAMINATION OF COTTON FABRIC CLOTHES FROM RADIOACTIVE SUBSTANCES. N. Yu. Tarasenko. Med. Radiol. 1, No. 5, 91-6(1956). (Translated from Referat. Zhur. Khim. No. 9, 1957, Abstract No. 33357.)

15295

THE POSSIBLE ATMOSPHERIC TRAJECTORIES OF RADIOACTIVE PRODUCTS FROM THE MARSHALL ISLANDS NUCLEAR EXPLOSIONS. D. A. Drogaitsev. Priroda No. 7, 78-80(1958). (In Russian)

15296

LONG-TERM FALLOUT. Merril Eisenbud and John H. Harley (U. S. Atomic Energy Commission, New York). Science 128, 399-402(1958) Aug. 22.

Data are presented on strontium-90 deposition and external gamma dose which were obtained from the world-wide gummed film network of the Atomic Energy Commission through June 1957. (C.H.)

15297

LONG-LIVED COBALT ISOTOPES OBSERVED IN FALLOUT. Peter O. Strom, James L. Mackin, Douglas Macdonald, and Paul E. Zigman (U. S. Naval Radiological Defense Lab., San Francisco). Science 128, 417-19 (1958) Aug. 22.

Radiochemical analysis of samples of fall-out obtained after one detonation of the 1956 nuclear weapon test series revealed the existence of cobalt-57, cobalt-58, and cobalt-60. To permit assessment of the relative internal hazards from the cobalt isotopes, determinations of strontium-90 were made on the same samples. From these data the Co^{60}/Sr^{90}, Co^{58}/Sr^{90}, and Co^{57}/Sr^{90} ratios were derived. Since all three cobalt isotopes emit gamma radiation, they would also contribute to an external hazard. (C.H.)

15298

SYNDROME AND MECHANISM OF RADIATION INJURIES. Rudolf Birkner (Städtischen Krankenhaus Moabit, Berlin). Strahlentherapie 106, 335-53(1958). (In German)

Based on clinical observations and experimental examinations the author describes the symptomatology and the mechanism of radiation-induced injuries in man. (auth)

15299

THERAPY OF SOMATIC RADIATION INJURIES. Heinz Oeser and Werner Rübe (Univ. of Berlin). Strahlentherapie 106, 364-77(1958). (In German)

The treatment of the somatic ray-damage requires a certain knowledge of the pathogenesis of the biological ray-effect. The execution and the data of the treatment, as well as the choice of the method should, however, not be determined by the morphological picture resulting from the irradiation, but by the functional reaction of the irradiated tissue (or organ). This conception is widely discussed in the present study and provided with practical instructions. (auth)

15300

RADIATION CHIMAERAS AND PARABIOSIS. Hedi Fritz-Niggli. Strahlentherapie 106, 378-90(1958). (In German)

X ray chimaeras were composed of x rayed (100–500 r) middle- and late stages of neurula and non-

irradiated germs of triton alpestris of the same age. Likewise, embryos were kept in parabiosis. The non-irradiated tissues were marked with vital staining. The x ray injury to the embryo is local, and the cell and tissue destruction is due to the preceding direct noxa. The growth of the x rayed tissue goes on. It is not supplanted and replaced by the non-irradiated tissue. The non-irradiated tissues are incapable of redressing the radiogenic lesions of the partner. Nor do the injured cells affect the development of the non-irradiated cells which are independent from them. In the united exterior metabolism (parabiosis), neither the disturbances of the development of an embryo x rayed at 100 r, nor the lethal effect of irradiation can be avoided. The non-irradiated partner is no protection. The embryo is not only sensitive to x ray because of the division of its cells, but because of its biochemical activity. The x ray injury to the embryo seems to consist in a sublethal, heredocellular lesion transforming the cells in an irreversible manner. This biochemical somatic mutation is only accessible to an intracellular therapy. (auth)

15301

INVESTIGATION ON THE IMPROVEMENT OF DESORPTION THERAPY BY MEANS OF RADIO ISOTOPE INCORPORATION. Emil Heinz Graul, Heinz Hundeshagen, and Wilhelmine Schömer (Phillips-Univ., Marburg/Lahn, Germany). Strahlentherapie 106, 391-6 (1958). (In German)

The introductory remarks of the report outline the problems of a successful desorption therapy with special regard to the radio-isotopes with bone-affinity. The group of chelate-forming substances is of particular importance in this connection. The animal tests described by the authors are based on the working hypothesis to combine the possibilities of a decalcification therapy with those of a therapy by means of chelate-forming substances. In these experiments, guinea-pigs are submitted to an intra-peritoneal application of strontium-90 (as chloride), and the rate of activity excretion is determined. After the gradual settling down of a certain equilibrium, desorption therapy by means of calciumethylenetetraacetic acid and parathormone was begun in single and combined applications. The results have shown that with the so-called combination therapy the excretion of strontium-90 strongly increased in comparison with the normal excretion. (auth)

15302

REMOVAL OF RADIOACTIVE CONTAMINATION FROM THE SKIN OF MEN. Willi C. Born (Universitats-Hautklinik, Freiburg i. Br.). Strahlentherapie 106, 435-45(1958). (In German)

On the strength of experimental research concerning the problem of radioactive contamination of the intact human skin, the new method of adhesive decontamination is explained. The method is most effective, practically universally applicable, uncomplicated, and not affected by undesired accompanying circumstances. (auth)

15303

INVESTIGATION ON A BIOLOGICAL RADIATION PROTECTION. XXIII. HOMOCYSTEINE THIOLACTON FOR RADIATION PROTECTION. Margarete Langendorff and Ruprecht Koch (Univ. of Freiburg/Br. and Heiligenberg-Instituts, Heiligenberg/Baden, Germany). Strahlentherapie 106, 451-7(1958). (In German)

d,l-a-homocysteinethiolacton-HCl was tested to its radioprotective effect in rats and mice. Intraperitoneal injection guarantees a sure protection in mice, if carried out by 30 minutes before the roentgen irradiation. An interval of 60 minutes between injection and irradiation reduces the effect to the region of LD_{10} to LD_{90}. If, however, 60 minutes before the ray insultus homocysteinethiolacton is administered to rats its protective effect is assured and covers a large region on both sides of the LD_{50}. Homocysteinethiolacton and N-acetyl-homocysteinethiolacton react in the same way and are of equal value. (auth)

15304

SAFETY TECHNIQUES FOR RADIOACTIVE TRACERS. J. C. Boursnell. Cambridge, Eng., University Press, 1958. 77p.

Radioactive materials may constitute a health hazard even when used in tracer amounts. Health hazards are enumerated, and procedures are presented for their control. (C.H.)

15305

EXPERIMENTS FOR DETERMINING THE PERMISSIBLE DOSES OF THERMAL NEUTRONS. A. G. Istomina and I. B. Keirim-Markus. pp. 136-48 in "Fizika i Teplotekhnika Reaktorov." Moscow, Publishing House on Atomic Power, 1958. 213p. (In Russian)

Radiation dosage from protons and x rays resulting from the thermal neutron capture by human organisms was studied in paraffin phantoms. With the relative biological effective of protons taken as 10, the maximum dosage distribution is on the body surface. The internal organs are mostly affected by γ radiation. The recommended maximum of permissible neutron flux on the body surface, per 8-hr working day, is found to be 6200 neutron/cm^2 sec and in the air 1250 neutron/cm^2 sec. The relative biological effectiveness equals 2 to 3 not 5 as it has been considered until now. (R.V.J.)

15306

MODIFICATION OF THE GENETIC EFFECTS OF X RAYS BY TREATMENT AFTER IRRADIATION. R. F. Kimball (Oak Ridge National Lab., Tenn.). pp. 252-5 in "Proceedings of the International Genetics Symposia, 1956, Tokyo & Kyoto, September, 1956" Tokyo, International Genetics Symposia, 1956, Science Council of Japan, 1957. 702p.

It has been demonstrated that the mutational process in Paramecium is not completed for 1 or 2 hours after irradiation but is completed well before the end of the interdivision interval in which the radiation is given. It is suggested that radiation initiates a mutational process that is irrevocably completed during late interphase and that this process is subject to spontaneous reversal before that time. Agents that delay the late interphase decrease mutation by allowing more time for spontaneous reversal. (auth)

Radiation Sickness

Refer to abstracts 15222 and 15229.

Radiotherapy

15307

A 45 MILLION VOLT LINEAR ACCELERATOR AS ELECTRON SOURCE FOR THE TREATMENT OF DEEP-LYING CARCINOMAS. Erich M. Uhlmann (Michael Reese-Hospital, Chicago). Strahlentherapie 106, 319-34(1958). (In German)

The author reports on a 45 million volt linear accelerator being used in Chicago for treatment of tumor patients with fast electrons. Principle and design are explained in detail. Because of the use of a Klystron the

tube is only 3 m long. Particular stress was placed on protection against rays. An alarm and safety system warrants sufficient safety. By scattering and subsequent narrowing, homogeneous distribution of electrons in fields up to 18 cm^2 can be obtained. The typical dose distribution is shown by means of isodose curves and their use in therapy is discussed. In biological tests an RBE of 2:1 or 1,4:1 and 1,2:1 respectively were found as compared with a 200 kv irradiation of adeno cancer of the uterus, inoperable cancer of the oesphagus and a tumor of the lungs. Tolerance and primary results were good. (auth)

15308

TUMOR LOCALIZATION BY PHOTOSCINTOGRAPHY BY MEANS OF RADIOISOTOPES. Cuno Winkler (Chirurgischen Universitatsklinik, Bonn). Strahlentherapie 106, 428-34(1958). (In German)

After giving a survey of the conditions necessary to prove tumors by means of radioactive isotopes, the author describes a method of photoscintography which allows intensification of contrast. Some examples serve to indicate the possibilities of clinical application and the practical importance of the method for the diagnosis of tumors. (auth)

Toxicology Studies

15309 IGO-AM/CA-174

United Kingdom Atomic Energy Authority. Industrial Group. Capenhurst Works, Capenhurst, Ches., England.

THE DETERMINATION OF MERCURY IN HUMAN URINE (ANALYTICAL METHOD). 1958. 6p.

A sample of urine is oxidized with potassium permanganate and sulfuric acid and the mercury extracted with dithizone solution. Interfering metals are first extracted from the dithizone solution with 0.1M hydrochloric acid. The mercury is then extracted with 5M hydrochloric acid and titrated against standard dithizone solution. The method is applicable to the determination of mercury in human urine containing from 20 to 200 μg mercury/liter. A precision check based on 130 determinations at the 40 μg/liter and 100 μg/liter levels has shown a positive bias of approximately 1% and a coefficient of variation of ± 8.3%. (auth)

15310

TOXICITY, EXCRETION AND TISSUE DISTRIBUTION OF IONIUM (Th^{230}) IN RATS. Irene U. Boone, Betty S. Rogers, D. C. White, and Payne S. Harris (Los Alamos Scientific Lab., N. Mex.). Am. Ind. Hyg. Assoc. J. 19, 285-95(1958) Aug.

The excretion, tissue distribution, and toxicity of ionium (Th^{230}) were studied following its intravenous administration in the rat. In addition, separate groups of animals were injected with ionium for histopathologic and radioautographic tissue studies. The results are summarized. (auth)

15311

THE STRONTIUM 90 CONTENT OF MILK FROM 1955-1957. D. Merten and E. Knopp. Kiel. milchwirtsch. Forschungsber. 10, 1-7(1958). (In German)

Since the liberation of atomic energy by the bombardment of heavy elements such as uranium and plutonium with neutrons, a large number of fission products with atomic numbers between 70 and 165 have been formed. The bomb tests cause these fission products to be carried to great altitudes and spread over the entire earth by air currents. In falling, the fission products contaminate the air layers next to the earth, the earth itself, and the waters, and then enter vegetable and animal organisms. They then become a source of danger for men. In order to obtain an estimate of the degree of actual contamination, the concentration of the most dangerous element, Sr^{90}, was determined from samples of milk from the German Federal Republic. Powdered milk was used as the oldest samples so that the increase in strontium in the last three years could be proved. The strontium was separated using the Harley and Whitney method. The counting of the samples then showed a definite increase of the strontium content. In 1955 the average value was 2.5×10^{-9} μc/cm^3 of milk, and in 1957 the value was 8×10^{-9} μc/cm^3. The strong dispersion of the results depend on geographic and meteorological influences as well as the type of soil and nutrition. (tr-auth)

Tracer Applications

15312 BNL-3757

Brookhaven National Lab., Upton, N. Y.

AUTORADIOGRAPHY WITH TRITIUM. Walter L. Hughes. [June 12, 1958]. 7p. Contract [AT-30-2-gen-16]. $1.80(ph OTS); $1.80(mf OTS).

Applications of tritium as a biological tracer are discussed. The advantages of tritium for the preparation of autoradiographs are pointed out. Studies are described in which tritium-labeled thymidine was used in studies on desoxyribonucleic acid synthesis. (C.H.)

15313 AEC-tr-3331

EFFECT OF ISOTOPIC AND NON-ISOTOPIC CARRIERS ON THE BEHAVIOR OF Sr^{90} IN THE RAT. (Uber den Einfluss isotopischer und nichtisotopischer Träger auf die Verteilung von Radiostrontium in Organismus der Ratte. A. Catsch. Translated for Oak Ridge National Lab. from Experientia 13, 312-13(1957). 2p.

The influence of calcium and magnesium levels on the bone deposition of intraperitoneally injected strontium-90 and yttrium-90 was investigated in rats. (C.H.)

15314

MOVEMENT OF SUBSTANCE PROXIMO-DISTALLY IN NERVE AXONS AS STUDIED WITH SPINAL CORD INJECTIONS OF RADIOACTIVE PHOSPHORUS. Sidney Ochs and Emil Burger (Univ. of Texas, Galveston). Am. J. Physiol. 194, 499-506(1958) Sept.

Small volumes of radioactive phosphorus (P^{32}) were injected into the lumbar 7th spinal cord of cats by means of fine glass capillaries to study the movement of substance down the motor axons. A gradient of flow over a period of days was indicated when the ventral roots were divided into portions proximal and distal from the cord and each measured for its content of P^{32} activity. The ratio of P^{32} activity of the lower to upper portions increased exponentially when plotted as a function of the number of days after injection. The possibilities of intra-axonal distal flow following an uptake of P^{32} by the cell body and dendrite, and an adventitious interaxonal (endoneural) distal flow was examined. Activity in the ventral roots was always greater than that in the dorsal roots. The asymmetry supports the concept of an intra-axonic movement since interaxonic flow should be equally possible in the ventral and dorsal roots. A group of animals had the L7 segments of their cords asphyxiated by means of local pressure which destroyed the motoneurons. In these animals, P^{32} was injected 1 week later. There was a greatly diminished P^{32} content in the ventral roots of animals so treated when sampled 1 week after injection. This evidence also supports the concept of an intra-axonic movement of substance distally in the axons. (auth)

15315

ISOTOPE EXPERIMENTS ON THE 2,6-DICHLOROPHENOLINDOPHENOL-MEDIATED OXIDATION OF ASCORBIC ACID BY ILLUMINATED CHLOROPLASTS. Helen M. Habermann and Leo P. Vernon (Univ. of Chicago and Brigham Young Univ., Provo, Utah). Arch. Biochem. Biophys. 76, 424-9(1958) Aug.

The use of oxygen isotopes revealed that when 2,6-dichlorophenolindophenol and ascorbic acid were added to a system containing illuminated Phytolacca chloroplasts functioning in a Mehler reaction, the rate of oxygen evolution was decreased to $^9/_{10}$ while the rate of oxygen consumption was increased to $2^3/_4$ times the original rates. After complete oxidation of the added ascorbate, the rate of oxygen evolution increased to $1^1/_2$ times the original rate. These results support the assumption that ascorbate can be oxidized via the (OH) system produced by the photolysis of water. (auth)

15316

SURVIVAL OF BLOOD PLATELETS LABELED WITH CHROMIUM. Knut A. Aas and Frank H. Gardner (Peter Bent Brigham Hospital and Harvard Medical School, Boston). J. Clin. Invest. 37, 1257-68(1958) Sept.

A standardized technique has been developed to evaluate the life span of transfused blood platelets in normal recipients. In vitro measurements indicate that radioactive sodium chromate will bind to human blood platelets suspended in plasma. The factors related to time, temperature, and concentration of sodium chromate for labeling platelets in vitro have been presented. $Na_2Cr^{51}O_4$ labeled platelets have been infused into 30 normal recipients. Determination of the radioactivity in the recipient's platelets separated by differential centrifugation indicates that the transfused platelets have a survival period of 9 to 11 days. No relabeling of the recipient's platelets or other blood elements was observed. The platelet radioactivity in the recipient declines for the most part in a linear fashion to suggest that this method does measure the life span of the transfused platelet. (auth)

15317

QUALITATIVE AND QUANTITATIVE AUTORADIOGRAPHY AND ESTIMATION OF ITS EFFICIENCY. Emil Heinz Graul and Heinz Hundeshagen (Phillips-Univ., Marburg/Lahn, Germany). Strahlentherapie 106, 397-404(1958). (In German)

The present study explains the methods of quantitative autoradiography, and especially the direct measuring of preparations by means of a selenium cell fitted into the microscope. Furthermore, the authors by inserting some examples demonstrate the efficiency of the stripping film method both for hard and soft β- and α-radiators. (auth)

15318

Y^{90} ORGAN DISTRIBUTION STUDIES WITH SPECIAL CONSIDERATION OF AUTORADIOGRAPHIC AND PAPER ELECTROPHORETIC DETECTION METHODS. Emil Heinz Graul and Heinz Hundeshagen (Phillips-Univ., Marburg/Lahn, Germany). Strahlentherapie 106, 405-17(1958). (In German)

By means of the usual measuring methods the authors have examined the metabolism of yttrium-90 by determining the specific activity (imp/min/g) and the total activity of the different organs. Furthermore, they made micro-autoradiographies (stripping film method) of each organ and carried out electrophoretic analyses of the blood serum and of the organic protein. Guinea-pigs served as test animals. With a constant carrier dose of 0.05 mg Y^{+++}/l mc, the yttrium-90 was given in intraperitoneal, intracardiac, and oral application. According to the mode of administration high specific activities could be observed in the organs important for the whole metabolism, as for instance in pancreas and hypophysis. By means of the autoradiographic pictures and the results of the paper electrophoresis the authors try to explain the results of the measurements. (auth)

CHEMISTRY

Refer also to abstracts 16045 and 16052.

15319 AECU-3769

Oregon. Univ., Eugene.

TEMPERATURE DEPENDENCE OF TAFEL SLOPE IN THE FORMATION OF VERY THIN ANODIC OXIDE FILMS ON NIOBIUM. George B. Adams, Jr., and Timothy Kao. [1957]. 14p. Contract AT(45-1)-535.

A kinetic study was made of the formation of very thin anodic oxide films on niobium at constant current over the temperature range −10 to 70°C. Formation voltages were limited to the range below the oxygen evolution potential to eliminate possible interaction of an electronic component of the current with the measured formation field. It was found that the measured temperature dependence of Tafel slope agreed with that predicted by the theory of Mott and Cabrera. Using this theory, a zero field interfacial barrier height of 1.19 ev and a half-jump distance of 2.40 A were obtained. Values of the differential formation field are reported at current densities of 1000, 100, 10, and 1 $\mu a/cm^2$ at ten degree intervals over the temperature range studied. (auth)

15320 AECU-3809

Westinghouse Electric Corp. Research Labs., East Pittsburgh, Penna.

REACTIONS OF URANIUM AND URANIUM OXIDE WITH WATER VAPOR AND OTHER GASES. Progress Report 100FF942-R1. Paul E. Blackburn and Earl A. Gulbransen. June 28, 1955. 18p. Contract AT-11-1-GEN-14. $3.30(ph OTS); $2.40(mf OTS).

A progress report on the design and construction of a reaction system and associated apparatus for the study of gas−metal reactions of uranium and uranium oxide with water vapor and other gases is presented. A sensitive vacuum microbalance technique was chosen to study the kinetics of these reactions, and a small mass spectrometer was incorporated in the apparatus to study the changes occurring in the gas atmosphere. (J.E.D.)

15321 AFOSR-TR-58-87

Forschungsinstitut für Physik der Strahlantriebe E. V., Stuttgart.

THE THERMODYNAMIC PROPERTIES OF HYDROGEN AND WATER AS POSSIBLE WORKING FLUIDS FOR NUCLEAR ROCKETS. Final Report. I. Sänger-Bredt. May 1958. 58p. Contract AF61(514)-910. (AD-162108).

Enthalpy-entropy diagrams were computed for either gas, with complete regard to dissociation, as well as ionization, over the pressure range between 10^{+1} and 10^{-5} atm, and within the temperature range between 500 and 10,000°K. Therefrom, the exhaust velocities possible for water, or water vapor, were derived, and compared with one another, with suitable supplies of energy, and on the assumption of equilibrium ratios, at various pressure gradients in the nozzles. The influence of the specific heats of mixtures and the mean molecular weights, on the exhaust velocities attainable−before and after heating−were shown in numerical examples for hydrogen, water, and helium. On the strength of the findings, additional hydrides of light elements have been

examined as to their applicability as working fluids and among these, boron (III)-hydride, as well as methane, are recommended for more detailed computation. In addition to the exhaust velocities, the heat transfers to the combustion chamber walls, occurring with equilibrium ratios, were examined by way of comparisons of hydrogen, water, and helium using parameters introduced earlier. The influence exerted by non-equilibrium processes on heating and expansion are discussed. Three characteristic, hypothetical limiting cases of incomplete equilibrium setting are examined. The kinetic energies obtainable in all three cases in the nozzle exit, with equal thermodynamic initial conditions in the combustion chamber, are comparatively computed with hydrogen and water. The probable extent and the form taken by divergencies from the energy equilibrium, that must actually be taken into account, when a working fluid is heated by means of an external energy source, were considered. Three methods of heating a working fluid have been investigated, namely fission reactors, arcs, and fusion reactors. (auth)

15322 ANL-5889

Argonne National Lab., Lemont, Ill.

HYDROGEN AND OXYGEN ISOTOPES APPLIED TO THE STUDY OF WATER–METAL REACTIONS. EXCHANGE OF D_2O^{18} WITH ALPHA ALUMINA MONOHYDRATE. R. B. Bernstein. Aug. 1958. 15p. Contract W-31-109-eng-38. $0.50(OTS).

Isotopes of hydrogen and oxygen may be useful in elucidating the mechanism of aqueous corrosion reactions, in which an important step may be diffusion of protons and/or hydroxyl (or oxide) ions through a thin protective film. The technique of isotope exchange and the kinetic isotope effect both appear applicable. For the reaction between water and aluminum, the product (above 90°C) is α-alumina monohydrate (α-AlOOH). The exchange of D_2O^{18} with α-AlOOH (sub-micron crystallite size) was examined from 100 to 230°C. The rate of D-H exchange was appreciable; O^{18} exchange was slow. The O^{18} content of the separate phases suggested that only half the O atoms in α-AlOOH are exchangeable. Results were interpreted on the basis of a slow step involving independent diffusion of protons and oxygen carrier ions. The activation energy for the proton diffusion coefficient was ~12 kcal. The isotope exchange technique was applied to the reaction between water and aluminum at 100°C. Al (type 1100) sheets reacted with H_2O to the "protective film" stage, then with D_2O. The D content of the film increased, but the net exchange (corrected for D uptake) was only slight. Impurities (Fe and Si) in the Al may enter into the α-AlOOH lattice and reduce proton mobility. Further corrosion-exchange studies with pure aluminum are needed to decide whether or not there exists a relationship between proton lability and corrosion rate. The D isotope effect on the rate of aqueous corrosion reactions should be useful in assessing the importance of proton mobility in the mechanism. (auth)

15323 ISC-928

Ames Lab., Ames, Iowa.

PRECIPITATION OF THORIUM AS THORIUM HYDRIDE FROM THORIUM–MAGNESIUM SOLUTIONS. Paul F. Woerner and P. Chiotti. Aug. 1957. 45p. Contract W-7405-eng-82. $1.25(OTS).

The precipitation of Th as thorium dihydride from Th–Mg solutions was investigated over the temperature range 665 to 810°C. (W.L.H.)

15324 NP-6910

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

DEVELOPMENT OF HIGH TEMPERATURE OXIDATION-CORROSION INHIBITORS TO IMPROVE STABILITY OF HIGH TEMPERATURE HYDRAULIC FLUIDS AND LUBRICANTS. Quarterly Progress Report No. 4 [for] March, April, May, and June 1958. Robert Brunier. Aug. 29, 1958. 23p. ARF Project C-103.

The objective of this research program is to synthesize and evaluate selected organic compounds as high temperature oxidation-corrosion inhibitors in mineral oils, synthetic ester lubricants, and silicone and silane fluids. As a result of this study specific inhibitors will be recommended for use. Some compounds were prepared which, according to previous test results, should have potential activity as inhibitors. The following compounds were prepared: N-(2-pyridyl)-1-naphthylamine, N,N'-Di-(2-pyridyl)-1,5-diaminonaphthalene, 10,10'-spirobiphenoxasilin, thiobutylstearamide, N-benzylthiobenzamide, N,N'diphenyl-2,5-pyrazine dicarboxylic acid dithionamide, and dimorpholinoyl-2,5-pyrazine dicarboxylic acid dithionamide. The testing program was devoted to the screening of new compounds. A large number of them contained the thionamide function which had previously been active. The compounds were tested for 24 hr at 550°F in the presence of 5% oxygen–95% nitrogen. The most efficient ones were also tested under more stringent conditions, 48 hr at 500°F in the presence of dry air. (auth)

15325 NP-6912

Minnesota. Univ., Minneapolis. School of Chemistry.

RECENT STUDIES OF THE BORON HYDRIDES. William N. Lipscomb. Aug. 14, 1958. 55p. Contracts DA-11-022-ORD-1554 and Nonr-710(23).

The systematic principles of boron hydride structure and chemistry are reviewed. Structures, valence theory with emphasis on charge distribution, nuclear resonance studies, derivatives and related compounds (simple substitution–not borohydrides) and brief remarks on interconversion are included in the discussion. (T.R.H.)

15326 NYO-8511

Drexel Inst. of Tech., Philadelphia.

FUNDAMENTAL EXPLORATORY INVESTIGATIONS OF CHEMICAL REACTIONS AT HIGH TEMPERATURES (500-1000°C). Annual Report [for] February 1, 1957 to July 31, 1958. Herbert H. Anderson and Lester Steinbrecher. July 7, 1958. 20p. Contract AT(30-1)-1998. $3.30(ph OTS); $2.40(mf OTS).

Three tables of the reactions of germanium, silicon, and titanium at 600°C, using the free element and the chloride of another element in each reaction, are reported. The report also contains the reactions of other elements with $GeCl_4$, $SiCl_4$, and $TiCl_4$ and some reactions of the elements zinc, cadmium, indium, thallium, zirconium, vanadium, tantalum, chromium, tungsten, manganese, rhenium, selenium, and tellurium. There is a total of approximately 187 successful reactions and 72 unsuccessful (or very slow) reactions. Careful study of this experimental evidence appears to justify the following over-all conclusions (these do not fit every reaction, but appear to fit the majority). In reactions between free elements and chlorides of other elements at high temperatures there is a tendency for a halide which has a high heat of formation per equivalent of halide to form. In reactions between free elements and chlorides of other elements at high temperatures there is a tendency for those halides with a comparatively low heat of formation per equivalent of halide to disappear. There is a tendency in these reactions to form lower halides, either temporarily or as final products. (auth)

15327 UCRL-8311

California. Univ., Berkeley. Radiation Lab.

CHEMISTRY OF +1 IODINE IN ALKALINE SOLUTION

(thesis). Yuan-Tsan Chia. June 2, 1958. 87p. Contract W-7405-eng-48. $13.80(ph OTS); $4.80(mf OTS).

The iodine species formed either by adding hypochlorite to a basic iodide solution or by adding triiodide to sodium hydroxide, was identified as hypoiodite ion. The absorption spectrum of IO^- was investigated in the wavelength range from 450 mμ to 280 mμ. The kinetics of the reaction $I^- + ClO^- = IO^- + Cl^-$ were studied spectrophotometrically in alkaline solution. The forward rate law was found to be $d(IO^-)/dt = k(I^-)(ClO^-)/(OH^-)$. At 25°C and an ionic strength of 1.00 M, k is 61 ± 3 sec^{-1}. It was found spectrophotometrically that for certain ratios of the initial iodide to hydroxide concentrations, there was evidence of the presence of I_3^-, I_2OH^-, and $I_2O^=$ along with IO^-. The equilibrium constants between IO^- and these three species were evaluated by a graphical method. The formal potential of the cell: Pt : H_2 : 1 M NaOH : 1 M NaOH, KI, NaIO : Au was found to be 1.297 v at 25°C. The equilibrium constant, $K_2 = (I_3^-)(OH^-)^2/(IO^-)(I^-)^2$, of the reaction $IO^- + 2I^- + H_2O \rightleftharpoons I_3^- + 2OH^-$ calculated from emf measurements agreed well with that from spectrophotometric measurements. The ionization constant of HOI was calculated to be 2.3×10^{-11} at 25°C. (auth)

15328 UCRL-8381

California. Univ., Berkeley. Radiation Lab.
ELECTROCHEMICAL STUDIES IN CYCLIC ESTERS (thesis). William Sidney Harris. July 17, 1958. 77p. Contract W-7405-eng-48. $2.00(OTS).

Solubilities and conductivities of inorganic salts in the cyclic esters ethylene carbonate, propylene carbonate, γ-butyrolactone, and γ-valerolactone have been studied. A number of common inorganic salts were found to be highly soluble in all of these solvents. The variation of solubility with the physical properties of the solvents is discussed. Conductivity measurements have shown that a number of salts investigated behaved as strong electrolytes. Certain solutions of highly soluble inorganic salts were found to have high viscosities in these solvents. Such relatively low-melting covalent halides as $AlCl_3$, $NbCl_5$, and $FeCl_3$ were found to be quite soluble. The solubilities and conductivities characterizing these solutions conform to present-day concepts, and are explained in the light of modern solubility theory. Solutions of a variety of salts were electroreduced, providing further data for the characterization of these solvents. This study indicates that, in addition to those metals which may be obtained from aqueous solutions, some of the highly electropositive metals may also be electrodeposited. These solvents are characterized by high dielectric constants, low vapor pressures, relatively low toxicity, and high chemical stability, and are relatively nonreactive with anodically liberated halogens. Such properties are desirable in an easily handled ionizing medium. (auth)

15329 AEC-tr-3278

THERMODYNAMICS OF MOLTEN MIXTURES OF CHLORIDES OF ALKALINE METALS AND THORIUM. M. V. Smirnov and L. E. Ivanovskii. Translated for Atomics International Div. from Zhur. Fiz. Khim. 31, 640-7(1957). 13p.

Electrode potentials of Th–Zn alloy relative to chlorine in molten LiCl–KCl containing 2.98 to 40.16 wt. % $ThCl_4$ at 840°C were measured. Below 25% $ThCl_4$ the melt acted as an ideal solution, but above this the experimental emf isotherm indicated an activity coefficient less than one. The isobaric potential variation was calculated for $ThCl_4$ (liquid) → 3.07 wt. % in KCl–LiCl eutectic. The equation for the electrode potential Th/Th^{4+} vs. temperature and concentration was derived. (T.R.H.)

15330 AEC-tr-3350

NEW DATA ON THE CHEMISTRY OF THE RARE ELEMENTS. I. V. Tananayev. Translated by Lydia Venters (Argonne National Lab.) from Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk, 1421-8(1957). 15p.

New data concerning the composition and the physicochemical properties of different compounds of some rare elements are communicated. Research concerning insoluble mixed ferrocyanides, which are developed by different metals with lithium, rubidium, and cesium is reviewed. In connection with this a series of new reagents-precipitants for the elements considered is recommended. The regularity of the alteration of the composition of the mixed ferrocyanides containing rare metals is recorded. Data on the composition and the stability of fluorides, oxalates, tartrates, and other compounds of gallium, indium, zirconium, and germanium are presented. (auth)

15331 AERE-Lib/Trans-791

DETERMINATION OF HYDROLYSIS CONSTANTS AND CONSTANTS OF COMPLEX–FORMATION OF Zr^{4+} WITH NITRATE AND CHLORIDE IONS BY EXTRACTION METHODS. A. S. Solovkin. Translated by V. Beak (U.K.A.E.A., Atomic Energy Research Establishment) from Zhur. Neor. Khim. 2, 611-22(1957). 19p.

A study was made of the complex formation of zirconium with the nitrate ion by the method of extraction into tributylphosphate from nitric acid solutions with an ionic strength of 4. It was found that zirconium is extracted into TBP in the form of the complex $Zr(NO_3)_4 \cdot TBP$, the composition of which was determined both by the graphical method (for a TBP concentration of 0.5 to 1M) and analytically. It is shown that the reaction constants of complex-formation of zirconium nitrate and chloride with TBP are, respectively, (0.65 ± 0.1) and $(2 \pm 0.2) \times 10^4$, and the reaction constant of complex-formation with thenoyltrifluoracetone is $(1.2 \pm 0.2) \times 10^9$. Calculations of the constants of complex-formation for the nitrate complex ions of zirconium, $Zr(NO_3)^{3+}$, $Zr(NO_3)_2^{2+}$, $Zr(NO_3)_3^+$ and $Zr(NO_3)_4$ gave values of 2.2 ± 0.05, 1.3 ± 0.05, 0.55 ± 0.03, and 0.15 ± 0.02, respectively. The constants of complex formation for the chloride complex ions of zirconium $ZrCl^{3+}$, $ZrCl_2^{2+}$, $ZrCl_3^+$ and $ZrCl_4$, with an ionic strength of solution of 6.54, were calculated as, respectively, 8.4 ± 0.5, 21 ± 1, 32 ± 2, and 15 ± 2. The constants for successive hydrolysis reactions of the Zr^{4+} ion were calculated; with an ionic strength of solution of 2, these were, respectively, 0.6 ± 0.05, 0.24 ± 0.03, 0.09 ± 0.01, 0.068 ± 0.006. (auth)

15332 NP-tr-129

ISOTOPIC EXCHANGE OF SOME MERCURY ORGANIC SALTS WITH METALLIC MERCURY MARKED WITH 203 Hg. O. A. Reutov and U Yan-Tsei. Translated for U.K.A.E.A. Atomic Energy Research Establishment from Doklady Akad. Nauk S.S.S.R. 117, 1003-6(1957). 6p.

Results of a study on the isotopic exchange of organic mercury salts with metallic mercury containing some Hg^{203} are presented. (W.L.H.)

15333 NP-tr-130

THE REACTION OF ISOTOPIC EXCHANGE OF SYMMETRIC MERCURY ORGANIC COMPOUNDS OF THE AROMATIC SERIES WITH MATALLIC MERCURY MARKED WITH 203 Hg. O. A. Reutov and G. M. Ostapchk. Translated for U.K.A.E.A. Atomic Energy Research Establishment, from Doklady Akad. Nauk S.S.S.R. 117, 826-8(1957). 6p.

Results of an investigation of the isotopic exchange reactions between diaryl mercury and metallic mercury containing the radioactive isotope Hg^{203} are presented. (W.L.H.)

15334

RESULTS OF LOW TEMPERATURE RESEARCH. XX. DIRECT COMPARISON OF THE VAPOR PRESSURE OF N_2^{14}, $N^{14}N^{15}$, AND N_2^{15} AS WELL AS $N^{14}O^{16}$, $N^{15}O^{16}$, AND $N^{14}O^{18}$ BETWEEN THEIR MELTING AND BOILING POINTS. Klaus Clusius and Kuno Schleich (Univ. of Zurich). Helv. Chim. Acta 41, 1342-58(1958). (In German)

The preparation of the gases $N_2N^{14}N^{15}$, N_2^{15}, NO, $N^{15}O$, and $N^{18}O$ and a cryostat for the comparison of the vapor pressures of the isotopic gas pairs are described. In the cryostat the temperature of both condensates agreed to within better than 10^{-3} degrees and remained constant over a period of an hour with this accuracy. The vapor pressure curve reduced to a pure isotopic molecule by a small extrapolation, between the melting and boiling points, has the form $\log(p_l/p_h) = 0.3985/T - 3.43 \times 10^{-3}$ for $N_2^{14}/N^{14}N^{15}$, $\log(p_l/p_h) = 0.7974/T - 6.91 \times 10^{-3}$ for N_2^{14}/N_2^{15}, $\log(p_l/p_h) = 3.0230/T - 13.40 \times 10^{-3}$ for $N^{14}O^{16}/N^{15}O^{16}$, and $\log(p_l/p_h) = 4.4684/T - 21.03 \times 10^{-3}$ for $N^{14}O^{16}/N^{14}O^{18}$, where p_l is the pressure of the light molecule and p_h is the pressure of the heavy molecule. The vapor pressure of $N^{14}N^{15}$ is within the measuring accuracy of the arithmetic mean of the vapor pressure of N_2^{14} and N_2^{15}. An effect of the molecular symmetry is not established in this case. The vapor pressure difference between the light nitrogen monoxide and the molecules of $N^{15}O$ or $N^{18}O$ are 3 to 5 times greater than in other diatomic gases on similar boiling points. The explanation of this may be connected with the association capacity of the condensed nitrogen monoxide. A simple relation between the molecular mass and the vapor pressure differences does not exist in these molecules formed from two different atoms. The important differences found are tabulated. By rectification of the nitrogen monoxide the nuclides N^{15}, O^{17}, and O^{18} could be obtained in a single process much easier and more economically than in other processes. (tr-auth)

15335

IDENTIFICATION AND ESTIMATION OF VARIATION IN PROCESS MEASUREMENTS. Fred H. Tingey (Phillips Petroleum Co., Idaho Falls, Idaho). Ind. Eng. Chem. 50, 1017-20(1958) July.

The application of standard statistical techniques to chemical processing is presented. The techniques greatly simplify statistical analyses of data obtained in a variety of error-component studies. The mathematical model is described, and examples are given. (J.R.D.)

15336

DECONTAMINATING RADIOACTIVE WATER. William J. Lacy and Wallace De Laguna (Oak Ridge National Lab., Tenn.). Ind. Eng. Chem. 50, 1193(1958) Aug.

The results of experiments using polymer coagulants with several types of ferruginous, calcareous, and glaconitic shale slurried in tap water to remove the radioactive nuclides by adsorption are presented. Certain long-chain high molecular weight polymers are efficient agents for the coagulation, and various types of shale are effective in radionuclide removal depending on the properties of the nuclides and the shale. (J.R.D.)

15337

ORGANIC COMPOUNDS OF ZIRCONIUM. V. STUDIES OF ZIRCONIUM MANDELATES. R. N. Kapoor and R. C. Mehrotra (Univ. of Lucknow, India). J. Am. Chem. Soc. 80, 3569-73(1958) July 20.

The reaction of zirconyl chloride with mandelic acid in aqueous solution yields mainly zirconium monomandelate which dissolves in one equivalent of alkali. The tetramandelate is formed only in the presence of higher concentrations of hydrochloric acid. The reaction between zirconium isopropoxide and mandelic acid in benzene shows that the carboxyl group is more reactive than the hydroxyl group in replacing isopropyl alcohol; the latter becomes active only when a sufficient concentration of carboxyl groups is not available. The following new compounds of zirconium have been isolated: $Zr(C_8H_6O_3)$-$(OPr\text{-}iso)_2$, $Zr(C_8H_6O_3)(C_8H_7O_3)(OPr\text{-}iso)$, $Zr(C_8H_7O_3)_2(OPr\text{-}iso)_2$, and $Zr(C_8H_6O_3)(C_8H_7O_3)(OBu)$. (auth)

15338

DIBORON TETRAFLUORIDE. Arthur Finch and H. I. Schlesinger (Univ. of Chicago). J. Am. Chem. Soc. 80, 3573-4(1958) July 20.

The preparation of diboron tetrafluoride by treating boron tetrachloride with antimony trifluoride is described. Its properties are given. (J.R.D.)

15339

HEATS OF FORMATION OF NIOBIUM DIOXIDE, NIOBIUM SUBNITRIDE AND TANTALUM SUBNITRIDE. Alla D. Mah (Bureau of Mines, Berkeley, Calif.). J. Am. Chem. Soc. 80, 3872-4(1958) Aug. 5.

The energies of combustion of niobium dioxide (NbO_2), niobium subnitride (Nb_2N) and, tentatively, tantalum subnitride (Ta_2N) were determined by bomb calorimetry. The results, in conjunction with the heats of formation of the corresponding pentoxides, lead to the following standard heats of formation at 298.15°K (kcal/mole): NbO_2, -190.9 ± 0.4; Nb_2N, -61.1 ± 1.0; and Ta_2N, -64.7 ± 3.0 (tentative). (auth)

15340

FACTORS AFFECTING THE TRANSPORT OF RADIOACTIVITY BY WATER. Franklin B. Barker (U. S. Geological Survey, Denver). J. Am. Water Works Assoc. 50, 603-12(1958) May.

Equations describing the transport of radioactivity by ground water are given, and the transport by surface water is discussed. The effects of the uptake of radioactivity by aquatic biota and water treatment of the transport is also discussed. The dispersal from slugs of dissolved substances injected into streams is a factor in radioactivity transport. Ion exchange studies made by the Geological Survey to evaluate the effects of radioactive waste disposal on water resources are described, and the results are discussed. 11 references. (J.S.R.)

15341

THE SIX-VALENT STATE OF POLONIUM. N. Matsuura and M. Haissinsky (Laboratorie Curie, Paris). J. chim. phys. 55, 475-82(1958) June. (In French)

The distribution of tetravalent polonium with concentrations of the order of 10^{-10} M between nitric or hydrochloric acid solutions and methylisobutylacetone is only slightly dependent on the acidity between 1 and 6 N, with approximately 80% of the Po being found in the organic phase at room temperatures. In sulfuric acid solution, the extraction ratio passes, as a function of acidity, through a minimum and a maximum. Whatever the acid, the presence of a strong oxidant (Ce^{4+}, Cr^{6+}) displaces the equilibrium strongly in favor of the aqueous phase. The reduction of the oxidant by oxygenated water reestablishes the initial distribution in the case of Ce^{4+}

ions and leads to an intermediate distribution with the bichromate, doubtless because of incomplete reduction. The distribution, in effect, depends on the ratio Cr^{3+}/Cr^{6+} or Ce^{3+}/Ce^{4+} in the solution. These experiments and analogous ones with tellurium confirm the existence of the VI valence of polonium and assigns to the potential of the Po^{4+}/Po^{6+} an approximate value of 1.5 volts. (tr-auth)

15342

CONSTITUTION DIAGRAMS OF IRON SULFIDE–NICKEL SULFIDE–COBALT SULFIDE (UP TO 30%). N. A. Anisheva and P. S. Kusakin (Inst. of Metallurgy, Urals Branch of Academy of Sciences, USSR). Zhur. Neorg. Khim. 3, 915-21(1958) Apr. (In Russian)

Physico-chemical analysis was made of the FeS–NiS_2–Co_4S_3 system. Diagrams for seven vertical (polythermal) sections of the system and orthogonal projections of liquidus isotherms for the system with up to 30% Co_4S_4 were plotted. The order and crystallization areas of the system from liquid to room temperature were determined. Phase structures of crystallization regions were revealed. (tr-auth)

15343

ON SOME CHEMICAL PROPERTIES OF THORIUM AND URANIUM. A. G. Karabash. Zhur. Neorg. Khim. 3, 986-95(1958) Apr. (In Russian)

The insoluble precipitations formed by uranium and thorium interactions with hydrochloric acid are analyzed. Reaction schemes are offered for uranium and thorium hydroxyhydride formations. The chemical and physical properties of complex hydrides were investigated. Investigations explain some of the chemical properties of thorium and uranium and correct some mistakes appearing in the literature. (R.V.J.)

15344

COMPLEX COMPOUNDS OF IRIDIUM AND RHODIUM WITH THIOUREA AND APPLICATIONS OF THIOUREA IN RECOVERY AND DETERMINATION OF THESE METALS. N. K. Pshenitsyn and I. V. Prokof'eva (Kurnakov Inst. of General and Inorganic Chemistry, Academy of Sciences, USSR). Zhur. Neorg. Khim. 3, 996-1001(1958) Apr. (In Russian)

It is shown that rhodium, iridium, platinum, palladium, and ruthenium can be quantitatively precipitated by thiourea. A gravimetric method is offered for rhodium and iridium determination by decomposing thiourea complex compounds by heating in concentrated solutions of sulfuric acid. The error order for 2 to 20 mg of rhodium or iridium is ±3%. The method can be applied for other platinum metals. (R.V.J.)

15345

SOLUBILITY DIAGRAM OF URANYL AND THORIUM NITRATES WITH SALTING OUT AGENTS. A. G. Kurnakova and A. V. Nikolaev. Zhur. Neorg. Khim. 3, 1028-36(1958) Apr. (In Russian)

The principle salting out agents in uranyl nitrate and thorium nitrate extraction were studied on seven quadruple systems and one triple system: NH_4NO_3–$UO_2(NO_3)_2$–HNO_3–H_2O, $Ca(NO_3)_2$–$UO_2(NO_3)_2$–HNO_3–H_2O, $Mg(NO_3)_2$–$UO_2(NO_3)_2$–HNO_3–H_2O, $Cu(NO_3)_2$–$UO_2(NO_3)_2$–HNO_3–H_2O, $Zn(NO_3)_2$–$UO_2(NO_3)_2$–HO_3–H_2O, $Cu(NO_3)_2$–$Th(NO_3)_4$–HNO_3–H_2O, $Fe(NO_3)_3$–$Th(NO_3)_4$–HNO_3–H_2O, $Al(NO_3)_3$–$Th(NO_3)_4$–H_2O. The solubility and specific gravities of the solutions were studied and diagrams plotted. (R.V.J.)

15346

XVIth INTERNATIONAL CONGRESS OF PURE AND APPLIED CHEMISTRY, PARIS, 1957. Basel and Stuttgart, Birkhäuser Verlag, 1957. 351p. (In English, French, and German)

The papers presented at the 16th International Congress are compiled. The papers are as follows: "Reflections on Chemical Kinetics"; "Stereospecific Catalysis and Stereoisomeric Polymers. Preparation of Fibers, Plastic Materials, and New Elastomers"; "Recent Research on the Actinide Elements"; "The Study of Combustion by Kinetic Spectroscopy"; "Some Properties of Water in Crystals"; "The Thermodynamic Theory of Diffusion"; "Study of Rapid Reactions by Means of Mass Spectrometry"; "The Chalcogenides of the Transition Elements"; "New Developments in Boron Chemistry"; "Protactinium and Neighboring Elements"; "High Temperature Chemistry. A Pioneering Field"; "The Synthesis and the Properties of Mineral Combination of Germanium"; "Investigations on Transanular Eliminations and Substitutions with the Help of Isotopes"; "The Initiation of Organic Chain Reactions"; "Complex Formation and Reactivity in Metallo-Organic Chemistry"; "Chemistry of Natural Tropolone and Allied Compounds"; "Structures of Some Alkaloids of the Delphinium"; and "Electronic Photoreactions of Organic Colorants." (J.S.R.)

15347

STUDY OF THE DIFFUSION OF BORON HYDRIDES IN SYNTHETIC AND NATURAL ZEOLITES. H. C. Beachell and John Andrew, Jr. J. chim. phys. 55, 280-4(1958) Apr. (In French)

The diffusion of diborane, pentaborane, and decaborane in natural and synthetic zeolites was studied. The natural zeolites studied were chabazite and mordenite. The synthetic zeolites were molecular "sieves" of 4, 5, and 13 A. It was shown that the slowness of the rate of sorption of the diborane on the chabazite was caused by the rapidity of the diffusion through the lattice which obeys the law of parabolic diffusion. The anomalies in the reversibility are attributed to the capacity of the boron hydride to diffuse through the porous structure and to its reactivity with the residual water in the zeolites. The differences in the sorption of different hydrides of boron on the zeolites can be explained by considering in the hydrides the angles and bond distances, as well as the structure of the zeolite pores. In order for a boron hydride to be absorbed by a zeolite, it is necessary that its critical dimensions by less than the effective diameter of the zeolite pore. It was found that the sorption was of a physical nature. (tr-auth)

15348

ANNOTATED BIBLIOGRAPHY ON THE USE OF ORGANOLITHIUM COMPOUNDS IN ORGANIC SYNTHESIS. SUPPLEMENT NO. 5, JANUARY 1, 1958. Minneapolis, Lithium Corporation of America, Inc., 1958. 165p.

The abstracts are listed alphabetically by author and are numbered consecutively. An index of the compounds appearing in the bibliography is presented. 451 references. (J.R.D.)

Analytical Procedures

Refer also to abstract 15309.

15349 AERE-C/R-2613

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE ANALYSIS OF THORIUM–INDIUM ALLOYS.

G. W. C. Milner and J. W. Edwards. June 1958. 9p. $0.32(BIS).

Indium is quantitatively separated from thorium by solvent extracting it into methyl isobutyl ketone from a solution 0.5M in sodium iodide and 1M in perchloric acid. Both constituents can then be determined volumetrically with EDTA. Thorium–indium alloys are dissolved in nitric acid with the aid of silicofluoride and after fuming to dryness with perchloric acid, the residue is dissolved in water. Indium is separated from an aliquot of the solution and the thorium content of the aqueous layer is obtained by titration with EDTA using xylenol orange as indicator. The organic solvent phase is vigorously stirred with an acetate buffer solution of pH 3 to 3.5 and the back extracted indium is titrated with EDTA using the same indicator. (auth)

15350 HW-42637

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

PROCESS POLAROGRAPHY: SOME PROBLEMS IN THE AUTOMATIC DETERMINATION OF URANIUM IN NITRIC ACID. C. E. Michelson and K. Koyama. Apr. 24, 1956. Decl. Sept. 11, 1958. 32p. Contract W-31-109-Eng-52. $6.30(ph OTS); $3.00(mf OTS).

A study of the effect of certain interferences and artifacts upon the appearance of the current-voltage wave and with the possible corrective measures to be considered in future design of polarographic units is presented. (W.L.H.)

15351 IGO-AM/CA-173

United Kingdom Atomic Energy Authority. Industrial Group. Capenhurst Works, Capenhurst, Ches., England.

THE DETERMINATION OF MERCURY IN ATMOSPHERE. 1958. 7p.

The sample is passed through acid potassium permanganate, and the absorbed Hg is determined by titration with dithizone solution. This method is suitable for the determination of Hg in the atmosphere in the presence of oil spray from vacuum pump exit gases and shows a negative bias of 3 to 5% based on tests of atmospheres containing Hg in the range 30 to 200 μg per cubic meter. (auth)

15352 ISC-780

Ames Lab., Ames, Iowa.

SOME PROPERTIES OF SULFOACETIC ACID AND 3-SULFOPROPIONIC ACID AND THEIR USE AS ANALYTICAL MASHING AGENTS. Joseph Zimmerman and Charles V. Banks. June 1956. 27p. Contract W-7405-eng-82.

The chemical properties of sulfoacetic acid and 3-sulfopropionic acid were studied. A spectrophotometric method for determining Al in Th using 3-sulfopropionic acid as masking agent is described. (T.R.H.)

15353 ISC-873

Ames Lab., Ames, Iowa.

ANNOTATED BIBLIOGRAPHY OF 2-(2-HYDROXY-3,6-DISULFO-1-NAPHTHYLAZO)-BENZENEARSONIC ACID. Charles V. Banks and Gerald L. Weiss. July 3, 1957. 18p. Contract W-7405-eng-82.

Twenty-nine references to published literature articles and reports on preparation, color reactions, and analytical uses of 2-(2-hydroxy-3,6-disulfo-1-naphthylazo)-benzenearsonic acid are given. (T.R.H.)

15354 LA-1721(2nd. Ed.)

Los Alamos Scientific Lab., N. Mex.

COLLECTED RADIOCHEMICAL PROCEDURES. (Radiochemistry Group J-11). Jacob Kleinberg, comp. Revised Jan. 1958. 325p. Contract W-7405-eng-36. $5.00(OTS).

This report supersedes LA-1566; LA-1567; LA-1721, 1st Ed.; and LA-1722.

The properties of the chemical elements are discussed on the basis of electronic configuration. Procedures for the separation from fission product materials and radiochemical determination of the following materials are presented: Be, Na, P, Ca, Sc, Cr, Fe, Co, Ni, Ge, As, Rb, Sr^{90}, Y, Zr^{97}, Nb, Mo, Ru, Rh, Pd, Ag, Cd, In, Sn, Sb, Cs, Ba, Ce, Eu, Ta, W, Ag, Tl, Pb, Bi, Th^{230}, Th, Pa, U^{235}, U^{237}, Np^{239}, Am, Cm, and Th isotopes. Preparation of carrier-free UX_1 (Th^{234}) tracer is given. (W.L.H.)

15355 NDA-38(Del.)

Nuclear Development Corp. of America, White Plains, N. Y.

DETERMINATION OF NITROGEN IN LITHIUM. (75-14). N. I. Sax, N. Y. Chu, R. H. Miles, and R. W. Miles. June 14, 1957. Decl. with deletions Apr. 10, 1958. For [Oak Ridge National Lab.]. Contract W-7405-eng-26, Subcontract 981. $1.80(ph OTS); $1.80 (mf OTS).

A summary of a method developed at NDA for the determination of nitrogen in lithium is presented. The nitrogen in lithium is considered to be present as lithium nitride. The analysis depends upon the hydrolysis of lithium nitride to form ammonia and lithium hydroxide. The ammonia is distilled off with the aid of a flow of argon, and is collected in 5 ml of 1% H_2SO_4 solution. The nitrogen is determined colorimetrically with Nessler's reagent. Nesslerized samples are tested for opalescence by checking for NH_3 content at 2 wavelength settings of the spectrophotometer or colorimeter, far enough apart to show a displacement due to opalescence. (auth)

15356 ORNL-2476

Oak Ridge National Lab., Tenn.

SEGREGATION IN URANIUM–ALUMINUM ALLOYS AND ITS EFFECT ON THE FUEL LOADING OF ALUMINUM-BASE FUEL ELEMENTS. W. C. Thurber and R. J. Beaver. Sept. 19, 1958. 24p. Contract W-7405-eng-26. $0.75(OTS).

Techniques were devised for quantitatively determining the accuracy of potentiometric uranium analyses in uranium-aluminum alloys containing up to 55 wt. % U and for evaluating the segregation existing in uranium-aluminum alloys containing as low as 7 wt. % U and as high as 50 wt. % U. A theory for predicting the mode of uranium segregation in these alloys was postulated. On the basis of the observed uranium segregation, the uranium content of a hypothetical fuel element was predicted by means of several sampling schemes. Dip sampling of the melt was demonstrated to be satisfactory for alloys containing 7 to 19 wt. % U. However, this technique was not considered suitable for alloys containing 40 to 50 wt. % U, because a significant number of samples is required from the casting or the wrought alloy to adequately represent the fuel content. (auth)

15357 RFP-83

Dow Chemical Co. Rocky Flats Plant, Denver.

ELECTROLYTIC CLEAN-UP AND REDUCTION OF URANIUM SOLUTIONS. R. L. Delnay and R. E. Perrin. Mar. 13, 1957. Decl. Feb. 3, 1958. 16p. $3.30(ph OTS) $2.40(mf OTS).

An accurate and rapid method for the volumetric determination of uranium has been developed for the

ranges 0.3% to 90% uranium. The existing mercury cathode deposition equipment has been modified for the rapid removal of metallic impurities and for the electrolytic reduction of the uranium. (auth)

15358 WAPD-CTA(GLA)-104-2
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
TYPE AND AMOUNT OF SAMPLE NEEDED FOR CHEMICAL ANALYSIS OF ZIRCONIUM, ZIRCALOY-2, AND HAFNIUM. Benjamin N. Nelson. Feb. 27, 1956. 2p. Contract [AT-11-1-GEN-14]. $1.80(ph OTS); $1.80(mf OTS).

The physical form of the sample was found to be of great importance in obtaining reliable results for chemical analysis. The machining method of obtaining chips for spectrographic analysis and nitrogen determination is of particular importance as is the amount of sample taken and precautions necessary to prevent contamination with foreign materials. (J.E.D.)

15359 WAPD-CTA(GLA)-191
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE DETERMINATION OF VANADIUM AS AN IMPURITY IN ZIRCONIUM AND ZIRCALOY. H. R. Wilson, D. L. Smith, and G. W. Goward. June 27, 1957. 4p. $1.80(ph OTS); $1.80(mf OTS).

Vanadium is oxidized with potassium chlorate in concentrated sulfuric acid to a yellow colored compound, probably a polyvanadate, and is determined by spectrophotometric measurement of the intensity of the color at 410 mu. The method covers the determination of vanadium as an impurity in zirconium and Zircaloy in the range 5 to 100 ppm. Interference by impurity and alloying iron, nickel, and chromium is eliminated by measurement of the absorbance of the samples against corresponding samples in which the vanadium color is not developed. (auth)

15360 WAPD-CTA(GLA)-515
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE DETERMINATION OF CADMIUM AS AN IMPURITY IN ZIRCONIUM AND ZIRCALOY. R. M. Burd. Jan. 23, 1958. 6p. $1.80(ph OTS); $1.80(mf OTS).

Cadmium is extracted as the diethyldithiocarbamate complex with chloroform from a hydrofluoric–boric acid solution at pH 1.0. The organic phase is stripped with nitric acid, and cadmium is determined colorimetrically as the dithizonate. Potassium cyanide is used to mask interfering metals in the dithizone extraction. The method covers the determination of cadmium in zirconium and Zircaloy in the range of 0.1 to 5.0 ppm on a two-gram sample basis. (auth)

15361 Y-978(Del.)
Carbide and Carbon Chemicals Co. Y-12 Plant, Oak Ridge, Tenn.
DETERMINATION OF HYDROXIDE IN LITHIUM HYDRIDE. H. A. Friedman. June 1, 1953. Decl. with deletions Dec. 4, 1957. 16p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40(mf OTS).

For the analysis of lithium hydride, hydroxide may be determined by Karl Fischer titration of water liberated by neutralization of the hydroxide with benzoic acid in methyl alcohol medium. Lithium oxide and lithium carbonate also react with the benzoic acid to form water, but only carbonate is corrected for because the weight of $O^{=}$ and OH^{-} are very nearly the same. The major source of error is from atmospheric contamination during sample handling, but may be overcome by employing a dry argon atmosphere. Initial standardization of the Karl Fischer reagent is with sodium acetate trihydrate, and daily standardizations are made with solutions of water in methanol. Indications of precision and accuracy are implied in data from analyses of lithium hydroxide, lithium carbonate, and two sets of mixtures of lithium hydride and lithium hydroxide. (auth)

15362 Y-1060(Del.)
Carbide and Carbon Chemicals Co. Y-12 Plant, Oak Ridge, Tenn.
ANALYSIS OF LITHIUM METAL, HYDRIDE, AND HYDROXIDE. V. PHOTOMETRIC DETERMINATION OF IRON. H. A. Friedman. Mar. 1, 1953. Decl. with deletions Dec. 4, 1957. 10p. Contract W-7405-eng-26. $1.80(ph OTS); $1.80(mf OTS).

Trace quantities of iron in lithium hydride, hydroxide, and metal may be determined photometrically at a controlled pH by reduction to Fe(II) with hydroxylamine hydrochloride, and formation of the ferrous o-phenanthroline complex. If the iron concentration is very low, preliminary concentration by carrier precipitation of ferric hydroxide on zirconium hydroxide may be necessary. Lithium does not appear to interfere with the determination. On the basis of ten aliquots of a 1 M lithium hydroxide solution spiked with 1 μg/ml iron, the limit of error at the 95% confidence level was found to be ±5.1%. (auth)

15363 AEC-tr-3354
POLAROGRAPHY IN NONAQUEOUS SOLUTIONS. V. Gutmann and G. Schober. Translated by K. S. Bevis (Savannah River Lab.) from Angew. Chem. 70, 98-104 (1958). 20p.

A survey of the literature on the polarography of nonaqueous solutions is presented. Fused salts are not included. 80 references. (L.T.W.)

15364 AERE-Lib/Trans-787
ANALYTICAL CHEMISTRY OF THE ACTINIDES. P. N. Palei. Translated by S. Botcharsky (U.K.A.E.A., Atomic Energy Research Establishment) from Zhur. Analit. Khim. 12, 647-64(1957). 23p.

An outline is presented of the properties and reactions used as a basis for the chemical methods of separating and determining the elements of the actinide group, mainly uranium, thorium, plutonium, neptunium, and americium. (J.E.D.)

15365
A DIFFERENCE PHOTOMETRIC METHOD FOR DETERMINING URANIUM IN PERCHLORIC ACID MEDIUM. T. W. Steele (Univ. of the Witwatersrand, Johannesburg, South Africa). Analyst 83, 414-21(1958) July.

A difference spectrophotometric method for determining uranium in perchloric acid medium is described. Factors affecting the accuracy have been studied. It is shown that chromium, vanadium, nickel, cobalt, sulfate, and phosphate interfere to a marked degree. (auth)

15366
NUCLEAR RADIATION TECHNIQUES FOR RADIOACTIVITY MEASUREMENTS. Ann. Intern. Geophys. Year 4, 7-17(1957).

A global network was set up to carry out the following operations: measurement of particulate airborne fission products at ground level; measurement of particulate airborne fission product activity at high altitudes; measurement of the deposition of fission product activity; measurement of natural radioactivity of the air; and determination of total fission products and radiocarbon in sea water. Standards are included for use in the measurements. (C.H.)

15367
DETERMINATION OF DEUTERIUM OXIDE IN WATER BY MEASUREMENT OF FREEZING POINT. Paul B.

Reaser and George E. Burch (Tulane Univ. and Charity Hospital of Louisiana, New Orleans). Science 128, 415-16(1958) Aug. 22.

A simple, rapid method is presented for the determination of deuterium oxide in water by measurement of the freezing point. (C.H.)

15368

CHROMATOGRAPHIC METHOD IN QUANTITATIVE ANALYSIS COMMUNICATION. IV. THE ANALYSIS OF CATIONS OF THE THIRD ANALYTICAL GROUP. K. M. Olshanova and K. V. Chmutov (Inst. of Physical Chemistry, Academy of Sciences, USSR). Zhur. Anal. Chem. 13, 162-71(1958) Mar.-Apr. (In Russian)

The third group cations present in solution were detected by means of aluminum oxide, perutite, and sulfunite absorbents and various developers and precipitators. Chromatographic qualitative analysis was made with aluminum oxide. The chromatographic analysis proved to be more sensitive than other methods. (R.V.J.)

15369

STUDIES OF THE ANALYTICAL CHEMISTRY OF THALLIUM COMMUNICATION I. COMPLEXOMETRIC DETERMINATION OF THALLIUM. A. I. Busev and V. G. Tiptsova (Lomonosov Moscow State Univ.). Zhur. Anal. Khim. 13, 180-5(1958) Mar.-Apr. (In Russian)

Amperometric titration of trivalent thallium with complexone III was shown to be feasible. 1-(2-Pyridylazo)-2-naphthol is an indicator for Tl^{3+} and permits the visual titration of Tl^{3+} with complexone III at pH $\leq$ 2. Large amounts of Zn, Cd, and Pb do not interfere in the complexometric determination of thallium. The method is suitable for the analysis of industrial materials. (tr-auth)

15370

USE OF COMPLEXONES IN POLAROGRAPHY. COMMUNICATION II. THE BEHAVIOUR OF MOLYBDENUM ON A DROPPING-MERCURY ELECTRODE IN COMPLEXONES. S. I. Sinyakova and M. I. Glinkina (Vernadskii Inst. of Geochemistry and Analytical Chemistry, Academy of Sciences, USSR). Zhur. Anal. Khim. 13, 186-92(1958) Mar.-Apr. (In Russian)

The reduction of molybdenum on a dropping-mercury cathode was studied in the presence of complexone I, complexone III, benzohydrylaminoacetic, hexamethylenediaminetetraacetic and cyclohexanediaminetetraacetic acids. In all those cases molybdenum was found to reduce in acid solutions. The values of half-wave potentials and diffusion currents depend greatly on the pH value. In alkaline solutions the molybdenum reduction wave is not formed. It is shown that the best results for analytical purposes can be achieved with complexone III. In the presence of complexone III Fe^{III} and Cu^{II} ions decrease the limiting molybdenum current; ions of Pb, Zn, V, and W practically do not interfere. (tr-auth)

15371

DETERMINATION OF SMALL AMOUNTS OF INDIUM BY TITRIMETRIC AND PHOTOMETRIC METHODS. E. N. Deichman and I. V. Tananaev (Kurnakov Inst. of General and Inorganic Chemistry, Academy of Sciences, USSR). Zhur. Anal. Khim. 13, 196-200(1958) Mar.-Apr. (In Russian)

A titrimetric method for determining indium by means of $Na_4[Fe(CN)_6]$ was suggested based on the formation of a precipitate of normal indium ferrocyanide $In_4[Fe(CN)_6]_3$. A colorimetric method has been suggested for determining small amounts of indium by means of a mixture of $K_3[Fe(CN)_6]$ and diphenylamine. (tr-auth)

15372

PHOTOMETRIC DETERMINATION OF CERIUM AS A PEROXIDE COMPLEX. A. K. Babko and O. M. Eremenko (Ukrainian Geological Board, Kiev). Zhur. Anal. Khim. 13, 206-10(1958) Mar.-Apr. (In German)

The principal defect of former methods is the precipitation of a colored compound. Glycerine has been suggested for stabilizing the solution in the presence of complexone III. When complexone III is used a finely dispersed colored cerium complex is formed and there is no need in stabilizers. The possibility of dissolving rare earths oxalates (without igniting them) by the direct dissolving of oxalates in sulfuric acid with persulfate or in nitric acid with permanganate was demonstrated. (tr-auth)

15373

PHOTOMETRIC DETERMINATION OF CERIUM AS CERIUM MOLYBDIC HETEROPOLY ACID. Z. F. Shakhova and S. A. Gavrilova (Lomonosov Moscow State Univ.). Zhur. Anal. Khim. 13, 211-14(1958) Mar.-Apr. (In Russian)

A new method for the photometric determination of cerium was developed based on the formation of cerium-molybdic heteropoly acid. Formation conditions and stability of a ceriummolybdic complex was investigated. (tr-auth)

15374

ANALYTICAL APPLICATION OF PHENOL-CARBONIC ACIDS OF THE TRIPHENYLMETHANE SERIES. DETERMINATION OF VANADIUM IN STEELS WITH THE USE OF ALUMINON. I. S. Mustafin and E. A. Kashkovskaya (Chernyshevskii Saratov State Univ.). Zhur. Anal. Khim. 13, 215-19(1958) Mar.-Apr. (In Russian)

A photocolorimetric method was developed for determining vanadium in steels of certain grades without separating interfering ions. (tr-auth)

15375

TRACE ANALYSIS. PAPERS PRESENTED AT A SYMPOSIUM ON TRACE ANALYSIS HELD AT THE NEW YORK ACADEMY OF MEDICINE, NEW YORK, NOVEMBER 2, 3, 4, 1955. John H. Yoe and Henry J. Koch, eds. New York, John Wiley & Sons, Inc., 1957. 683p.

The various modifications of chromatographic and electrochromatographic methods are described, and the conditions requisite for the application of these methods to the separation of trace substances are examined. The application of ion exchangers and ion-exchange columns to trace analysis is described. The features of countercurrent distribution in trace analysis are presented. The use of chemical microscopy in the identification of chemical compounds is described. From the standpoint of trace-analysis applications, spot tests are the most sensitive of the ordinary microchemical techniques. A perspective is presented of the current status of colorimetric methods of analysis; both their merits and their limitations are summarized. Fluorimetric methods are presented for a number of inorganic ions. The general principles of flame excitation and its applicability for spectrochemical analysis are reviewed. A brief review of typical specific applications of potentiometry to titrations in various fields of volumetric analysis is given. Coulometric techniques are presented. Polarographic and voltametric methods are described from the standpoint of trace analysis. The basic principles and applications of emission spectrochemical analysis are given. The basic tools needed to perform gamma-ray spectroscopy are discussed. The various methods

of mass spectroscopy are presented. X-ray spectroscopy and x-ray micrography are discussed. The slope, advantages, and limitations of neutron-activation analysis are briefly reviewed. Microbiological techniques are presented. Part two and three of the volume are concerned with instrumentation and sensitivity, separation, concentration, and contamination, respectively. (W.L.H.)

15376

EMISSION SPECTROMETRIC DETERMINATION OF OXYGEN IN METALS. Velmer A. Fassel, William A. Gordon, and Ray W. Tabeling (Iowa State Coll., Ames). Special Technical Publication No. 221. Philadelphia, American Society for Testing Materials, 1958. 20p.

The problems encountered in extending emission spectrometric methods to the determination of the oxygen content of metals are surveyed and several techniques for surmounting some of these problems are discussed. Methods for the determination of oxygen in steel, titanium, the rare earths, and other metals are presented in detail. These procedures are based on the liberation of the oxygen content of the metal into an argon atmosphere by the high temperatures attained in direct-current arc discharges. The intensity ratio of the line pair 07771A/A7891A is related to the oxygen content of the metal sample. The procedures described determine oxygen with a precision comparable to vacuum fusion or bromination–carbon reduction techniques and have the advantage of greatly reduced time requirements. (auth)

Atomic Weights and Periodic Systems

15377

PROPOSITION FOR A UNIFIED SCALE OF NUCLIDE MASSES AND ATOMIC WEIGHTS WITH C^{12} AS ITS BASE. T. P. Kohman (Carnegie Inst. of Tech., Pittsburgh); J. Mattauch (Max-Planck-Institut fur Chemie, Mainz, Germany); and A. H. Wapstra (Instituut voor Kernphysich Onderzoek, Amsterdam). J. chim. phys. 55, 393-5(1958) May. (In French)

The use of the physical and chemical scale causes much time to be spent in relating one scale to the other for many measurements. C^{12} is proposed as the base of a unified scale. The unit of mass using this base is 318 millionth higher than the present physical scale and 43 millionth higher than the chemical scale. The advantages of this scale are discussed. (J.S.R.)

Deuterium and Deuterium Compounds

Refer also to abstract 15998.

15378

LOW TEMPERATURE DISTILLATION OF HYDROGEN ISOTOPES. K. D. Timmerhaus, D. H. Weitzel, and T. M. Flynn (National Bureau of Standards, Boulder, Colo.). Chem. Eng. Progr. 54, No. 6, 35-46(1958) June.

A description of the NBS experimental program at Boulder, Colo., is presented. A pilot plant for distillation of liquid hydrogen to recover hydrogen deuteride is in operation. A detailed discussion of the research and development leading to the construction and operation of the plant is presented. (J.R.D.)

15379

ELECTRON-COUPLED INTERACTION BETWEEN NUCLEAR SPINS IN HD MOLECULE. Eiichi Ishiguro (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 111, 203-8(1958) July 1.

Electron-coupled interaction between two nuclear spins I_A and I_B is of the form $h\delta_{AB} I_A \cdot I_B$. Formulas for calculating δ_{AB} are derived by using the variational method. By using these formulas, we have calculated δ_{AB} of the HD molecule at internuclear distances of 1.3, 1.4, and 1.5 atomic units. The total wave function was chosen as a linear combination of seven independent functions of $^1\Sigma_g^+$ symmetry, representing the unperturbed state, and several additional functions, to represent the perturbation. The average value of δ_{AB} over the zero-point vibration, $(\delta_{AB})_{00}$, is found to be 37.138 cps. Further, the refinement of a part of the calculations is undertaken by use of the 11-term James and Coolidge wave function. The final result is $(\delta_{AB})_{00} = 35.217$ cps. The agreement with the observed value of 42.7 ± 0.7 cps is satisfactory, considering that we have used only a few terms for the additional perturbative wave function and that the result is a sum of terms which cancel each other appreciably. Contributions from each perturbing Hamiltonian and also from a set of wave functions with different symmetry character were obtained separately. The various results are presented and discussed. (auth)

15380

PREPARATION OF DEUTERIUM OXIDE AND DETERMINATION OF ITS DENSITY. A. I. Shatenshteyn, L. M. Yakimenko, V. R. Kalinachenko, and Ye. A. Yakovleva. Zhur. Neorg. Khim. 2, 985-94(1957). (Translated from Referat. Zhur. Khim. No. 3, 1958, Abstract No. 7097.)

An installation for the preparation of D_2O was constructed, and deuterium oxide of a high degree isotope purity was prepared. The density of D_2O was measured at 25, 30, 40, and 50°.

Fluorine and Fluorine Compounds

Refer also to abstract 16044.

15381 GAT-234

Goodyear Atomic Corp., Portsmouth, Ohio.

REACTIONS OF FREON-114 WITH FLUORINE. F. E. Massoth. May 14, 1958. 41p. Contract AT(33-2)-1. $1.25(OTS).

An efficient flow process for the degradation of Freon-114 to carbon tetrafluoride has been developed. Various operating variables were studied under laboratory conditions, and fluorination of Freon-114 was found to proceed exclusively by substitution at temperatures below 450°C and by degradation at temperatures above 500°C. The difference in mechanism is explained on the basis of greater temperature dependence for the degradation process than for the substitution reaction. Indirect evidence for a free radical reaction mechanism, based on kinetic studies of the substitution reaction between 400 and 450°C, was obtained. Low-temperature (225 to 250°C) Freon-115–fluorine substitution appears to involve surface reactions. (auth)

15382 MLM-1079

Mound Lab., Miamisburg, Ohio.

VISCOSITY OF FUSED MIXTURES OF SODIUM FLUORIDE, BERYLLIUM FLUORIDE, AND URANIUM FLUORIDE. B. C. Blanke, K. W. Foster, L. V. Jones, K. C. Jordan, R. W. Joyner, and E. L. Murphy. Apr. 1956. 90p. Contract AT-33-1-GEN-53. $2.25(OTS).

The viscosity of mixtures in the ternary system sodium fluoride–beryllium fluoride–uranium fluoride was investigated over the temperature range from 900 to 450°C, or to the liquidus point on compositions having

a liquidus below 850°C and high vapor pressure. The results are given in tabular and graphic form. (auth)

15383 NAA-SR-2710

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

VAPOR PRESSURE OF THORIUM TETRAFLUORIDE. A. J. Darnell and F. J. Keneshea, Jr. Sept. 1, 1958. 14p. Contract AT-11-1-GEN-8. $0.50(OTS).

The vapor pressures of solid and liquid ThF_4 have been determined. For the solid phase, the Knudsen effusion method was used over the temperature range of 1055 to 1297°K; for the liquid, the quasi-static method of Rodebush and Dixon was used between 1437 and 1595°K. The vapor pressure equation for the solid is $\log P_{(atm)} = -16{,}860/T + 9.105$; and for the liquid, $\log P_{(atm)} = -15{,}270/T + 7.940$. The heat of vaporization at the extrapolated boiling point (1953°K) is 61.6 kcal per mole, using an estimate of −19 cal per deg per mole for ΔCp. Both the vapor pressure results and a mass spectrometric examination of the vapor indicate that thorium tetrafluoride vaporizes as the monomer. (auth)

15384 NACA-TN-4374

Lewis Flight Propulsion Lab., Cleveland.

RATE OF REACTION OF GASEOUS FLUORINE WITH WATER VAPOR AT 35°C. Vernon A. Slabey and Edward A. Fletcher. Sept. 1958. 16p.

Fluorine and water vapor react extremely slowly or not at all in the gas phase at 35°C at partial pressures of the reactants up to 40 mm of mercury. They react at surfaces; the kinetics are first order with respect to each of the reactants. At Kel-F wax-coated surfaces, the rate of disappearance of fluorine is expressed by $-dF_2/dt = 1.6 \times 10^{-4} A_w[F_2][H_2O]$, where $-dF_2/dt$ is the rate of disappearance of fluorine in moles per second, A_w is the surface area (sq cm) of the reaction vessel, and $[F_2]$ and $[H_2O]$ are the concentrations in moles per liter of the reactants. Neither ozone nor hydrogen peroxide is formed to a measurable extent in the reaction. (auth)

15385

COMPLEX FLUORIDES OF QUADRIVALENT OSMIUM AND IRIDIUM AND THE CORRESPONDING FREE ACIDS. M. A. Hepworth, P. L. Robinson, and G. J. Westland (King's Coll., Newcastle upon Tyne, Eng.). J. Chem. Soc. 611-13(1958) Feb.

Complex fluorides of osmium and iridium, $M^I{}_2M^{IV}F_6$, where M^I is NH_4, Me_4N, or Na, and aqueous solutions of the corresponding fluoro-acids H_2OsF_6 and H_2IrF_6 were prepared. The lattice constants and some other properties of several of the compounds are given. (auth)

15386

DIELECTRIC LOSS AND ADDITIVE COLORATION OF CALCIUM FLUORIDE. G. Jacobs (Laboratorium voor Kristalkunde, Gent, Belgium). J. chim. phys. 55, 472-4(1958) June. (In French)

Experimental results are reported on the crystals of CaF_2 contaminated with oxygen where some of the crystals have additive coloration. The dielectric loss of noncolored crystals was determined following a thermal treatment in air at 600 to 900°C and lasting from 4 to 5 hours. The conductivity caused by free carriers is increased, and a slight dipolar absorption appears. Preliminary results on the additive coloration of CaF_2 with the addition of oxygen are briefly discussed. The conductivity of colored crystals, additively colored in different ways, was measured. All crystals showed a dielectric loss. (J.S.R.)

Graphite

Refer also to abstracts 15965 and 16046.

15387 NP-6897

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

GRAPHITE TECHNOLOGY. Progress Report No. 8 for the period June 1 to August 1, 1958. S. W. Bradstreet. 23p. Project No. G-033. Contract AF33(616)-5185.

The room-temperature properties of small specimens of molded multicrystalline graphite are described. The specimens were: a pitch-bonded petroleum coke flour "standard" mix, several pitch-petroleum coke-thermal carbon mixes, mixes containing furfuryl alcohol as binder, and a mix in which a heavy metal oxide was substituted for part of the petroleum coke. In addition, the room-temperature properties (density, orientation factor, dynamic and static flexural moduli, ultimate flexural strength, and flexural elastic limit) were measured for a commercial, high-density, impregnated, molded graphite. The experimental specimens were reduced in number to approximately 500; these were graphitized to 2860°C in a nitrogen atmosphere in a single batch. Apparent (water) densities as high as 1.81 gm/cc can be achieved with the pitch-bonded coke flour system alone. This corresponds to a mercury density of more than 1.88 gm/cc, or about 93% of the theoretical density. Still higher densities can be attained if somewhat more than 15 or less than 13% of thermal carbon is substituted for petroleum coke flour; this is shown to act as a lubricant in molding and enhances shrinkage during graphitization. In general, the density of experimental specimens exhibits the lowest standard deviation in the green state; the carbonizing process increases this two- or threefold when the binder is aged and the carbonizing cycle is slow; graphitization need not greatly increase, and may even decrease, density variation. The room-temperature properties for ATJ graphite are reported. A simple and sensitive method is described of measuring surface anisotropy by comparison of immersion densities (in water) for specimens of differing shapes. (For preceding period see NP-6767.) (auth)

15388

THE ELECTRIC PROPERTIES AND STRUCTURE OF TRANSITIONAL FORMS OF CARBON. V. I. Kasatochkin and A. T. Kaverov (Inst. of Fuel Deposits, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 120, 1007-10(1958) June 11. (In Russian)

Investigations were made of the thermo-electromotive forces, electric resistance, and structure of amorphous carbon transitions to graphite during the high-temperature treatment of various types of initial carbons. (R.V.J.)

15389

THE HEAT OF ADSORPTION OF HYDROCARBONS ON CARBON BLACKS OF DIFFERENT DEGREES OF GRAPHITIZATION. N. N. Avgul', G. I. Berezin, A. V. Kiselev, and A. Ya. Korolev (Inst. of Physical Chemistry, Academy of Sciences, USSR). Kollid. Zhur. 20, 298-304(1958) May–June. (In Russian)

A study of the adsorption and of the differential heats of adsorption of 3-methylhexane and of benzene on graphitized carbon blacks showed that an increase in graphitization temperature of the blacks from 1700 to 2800°C changes little their adsorption properties. Hy-

drocarbon adsorption on graphitized carbon black obeys the equation of polymolecular adsorption in which account is made for the interaction of adsorbate molecules in the first adsorption layer. The heats of adsorption of hydrocarbons on carbon black graphitized at 2800°C are close to the theoretical values for the potential of adsorption forces calculated previously. (tr-auth)

Laboratories and Equipment

15390 AEC-tr-3342

ON THE CHARACTERISTICS OF A CENTRICLONE. Y. Mori, R. Aoki, A. Saito, T. Tsushima, and M. Nobue. Translated for Oak Ridge National Lab. from Chem. Eng. (Japan) 22, 7-15(1958). 19p.

The classifying efficiency of a centriclone using a suspension of aluminum hydroxide slurry up to a concentration of 10 wt. % was investigated. The liquid motion has a peripheral velocity which is almost constant in the outer vortex, and the inner vortex has a constant angular velocity like a rigid body. Most of the inner vortex can be removed from the outlet for light liquids, but some will remain in the centriclone, forming an inner circulating flow. The centriclone is a dynamic combination of a hydraulic cyclone and a centrifuge; however, it is superior to a conventional hydraulic cyclone because it can classify an aluminum hydroxide slurry of 2 to 10 wt. % concentration and homogeneous in particle size. (J.R.D.)

15391 AEC-tr-3343

MOTION OF WATER IN A HYDRAULIC CYCLONE. H. Ohashi and S. Maeda. Translated for Oak Ridge National Lab. from Chem. Eng. (Japan) 22, 200-7(1958). 16p.

The loci of polystyrene particles in aqueous suspension were photographed in various horizontal and vertical sections from which the velocity distribution of water in a hydraulic cyclone was measured. The absolute velocity was measured by means of a special stroboscope (which had been equipped with two spotlights and which fired at definite time intervals), and from which the values of u_t, u_r, and u_z at various positions were calculated. From the peripheral part to the region of maximum velocity, u_t takes the form of a semi-free vortex and approaches the form of a free vortex as it descends. Within the region between the radial position of maximum velocity to the air column, it is a rigid vortex. There were fluctuations in the vertical velocity component u_r, it is also asymmetrical and contains a secondary flow. There were areas of inward flow near the wall and the central part and between these two there was an outward flow whose absolute velocity was larger at the lower part of the cyclone. There were also fluctuations and secondary flow in the vertical velocity component u_z. There is a downward flow near the wall and an upward flow within. The downward flow near the wall increases as the position is lowered. Near the central part at which the flow starts to turn into an upward flow, the upward velocity gradually increases up to the air column in the case of the flow ratio R = 0. There is a downward flow near the center and, therefore, there exists a maximum for the upward velocity in the case of R = 1. In the case where R = $\frac{1}{6}$, the tendency resembles that of the flow of R = 0 in the upper portion and resembles that of the flow of R = 1 in the lower portion. The material balance of the water passing through the horizontal sections was calculated, from which it was considered that the flow in the lower portion of the cyclone had special importance for the separation of solid particles in suspension. These results were also compared with the experimental results reported by Kelsall. (auth)

15392

A PORTABLE MULTIPURPOSE AIR SAMPLER. Robert E. Earhart (Goodyear Atomic Corp., Portsmouth, Ohio). Am. Ind. Hyg. Assoc. J. 19, No. 1, 63-5 (1958) Feb.

A compact, portable air sampler designed primarily for use with impinger flasks at a sampling rate of 0.5 cubic feet per minute is described. With simple modification the sampler may be used for a wide variety of air-borne contaminants at various sampling rates; the apparatus weighs about 25 lbs and operates on either 6 or 110 volt current. (J.R.D.)

15393

SIMPLE, GAS-TIGHT FURNACE FOR INDUCTION HEATING. R. D. Grinthal (Firth Sterling, Inc., Yonkers, N. Y.). Powder Met. Bull. 8, 68-9(1958) June.

As a means of attaining high temperatures in pure atmospheres a furnace was constructed in which the atmosphere can be controlled at any degree between high vacuum and positive gas pressure. Temperatures up to 1900°C were attained. A detailed description of the furnace design including possible refinements and materials of construction is given. (J.R.D.)

Molecular Structure

15394

THE OPTICAL PROPERTIES AND STRUCTURES OF $CaO \cdot 2Al_2O_3$ AND $SrO \cdot 2Al_2O_3$. E. R. Boyko and L. G. Wisnyi (Knolls Atomic Power Lab., Schenectady, N. Y.). Acta Cryst. 11, 444-5(1958) June.

The compound $CaO \cdot 2Al_2O_3$ is biaxial positive with the difference in alpha and beta so small as to be imperceptible with ordinary petrographic equipment. The structure determination of the isomorphic $SrO \cdot 2Al_2O_3$ defines the complete nature of the phase. (J.R.D.)

Radiation Chemistry

15395 UCRL-8362

California. Univ., Berkeley. Radiation Lab.
THE RADIATION CHEMISTRY OF THE SYMMETRICAL DICHLOROETHYLENES (thesis). Jean H. Futrell. July 1958. 58p. Contract W-7405-eng-48. $1.75(OTS).

Purified, degassed samples of cis- and trans-1,2-dichloroethylene were irradiated in glass cells with 48-Mev helium ions at energy inputs up to 10^{21} ev/cc. The principal volatile radiolysis products are acetylene, hydrogen chloride, chloroacetylene, vinyl chloride, hydrogen, and dichloroacetylene, in order of decreasing yield. The use of a mass spectrometer in conjunction with gas chromatography made possible the identification of several higher-boiling, or "polymer," products as tetrachloroethane, tetrachlorobutene, and pentachlorobutene isomers. However, about half of the higher-boiling material proved to have too low a vapor pressure (b.p. > 300°) at the highest practicable column temperature for these techniques to yield any clues to its nature. Hence these products were characterized only by yield, average molecular weight, and average composition. The effect on product yields of the variation of certain kinetic parameters—total dose, density of initial excitation, and temperature—was determined in survey experiments. These included irradiation with helium ions at 80° and at room temperature, irradiation

with electrons of differing energy distributions provided by a microwave linear accelerator and by a Van de Graaff machine, and irradiation with Co^{60} gamma rays. There are no significant differences in the radiolytic behavor of the cis- and trans- isomers of 1,2-dichloroethylene, and the nature and yields of radiolysis products are explicable on the basis of a series of free-radical reactions. Primary processes of scission of carbon-chlorine bonds and molecular elimination of hydrogen chloride, followed by reactions deduced from the nature of the reactive fragments, presents a self-consistent correlation of the experimental data. The yield of disappearance of monomer is of the order of 15 to 20 molecules per hundred electron volts for both isomers, indicating that chain reactions occur. The relatively short chain length and the structural identification of the polymer products that were isolated are in agreement with the postulate that rather unreactive, long-lived polychloro free radicals are formed in these systems. (auth)

15396

STUDIES INVOLVING ISOTOPICALLY LABELLED FORMIC ACID AND ITS DERIVATIVES. III. POSITIVE AND NEGATIVE IONS PRODUCED BY ELECTRON IMPACT IN FORMIC ACID AND DEUTEROFORMIC ACIDS. Gus A. Ropp and C. E. Melton (Oak Ridge National Lab., Tenn.). J. Am. Chem. Soc. 80, 3509-12(1958) July 20.

The principal positive and negative ions in the mass spectra of formic acid and deuteroformic acids are reported. It is shown that the positive ions of mass 45 (CHO_2^+), 29 (CHO^+), and 13 (CH^+) are formed by reactions involving loss of hydrogen from either position in the formic acid molecule. Loss of the hydrogen attached to carbon occurs only a little more readily than loss of the other hydrogen in the formation of the ion CHO_2^+. Loss of the hydrogen attached to oxygen occurs more readily in the formation of the ions CHO^+ and CH^+. Negative ions of masses 45 (CHO_2^-) are formed almost exclusively by loss of the hydrogen attached to oxygen. The relative sensitivities for formation of negative ions from formic, acetic, and propionic acids are approximately those predicted from the structures of these acids. (auth)

15397

BOND RUPTURE OF HBr^{80m} FOLLOWING NUCLEAR ISOMERIC TRANSITION. Ray H. Luebbe, Jr. and John E. Willard (Univ. of Wisconsin, Madison). J. Chem. Phys. 29, 124-7(1958) July.

When the Br^{80m} in HBr^{80m} undergoes isomeric transition the HBr^{80} bond is broken in 93% or more of the events rather than only 75% as indicated by earlier work. In gaseous mixtures of HBr, CH_3Br, and 1,2-dibromoethylene containing either HBr^{80m} or CH_3Br^{80m}, the distribution of the Br^{80} daughter between organic and inorganic combination is dependent upon the $HBr/C_2H_2Br_2$ ratio, indicating that $C_2H_2Br_2$ does not compete as effectively with HBr for the Br^{80} atoms as formerly thought. (auth)

15398

RADIATION STABILITY OF LIQUID CYCLOÖCTATETRAENE. Shoji Shida, Hideo Yamazaki, and Shigeyoshi Arai (Tokyo Inst. of Tech.). J. Chem. Phys. 29, 245-6(1958) July.

Cycloöctatetraene was irradiated at low pressure for several days with gamma rays from Co^{60} at a dose rate of about 5300 r/min, total doses ranging from 30 to 50 mr. The H_2 and acetylene produced were identified and measured, and other products were measured after distilling the unreacted cycloöctatetraene out of the reaction cell. It is evident that liquid cycloöctatetraene is one of the most radiation-stable organic liquids. (J.R.D.)

15399

CHEMICAL ACTION OF IONISING RADIATIONS IN SOLUTION. PART XXII. THE RADIATION CHEMISTRY OF ARSENITE SOLUTIONS: THE ACTION OF X-RAYS (200 kv) ON AQUEOUS SOLUTIONS OF ARSENITE. M. Daniels and J. Weiss (Univ. of Durham, Eng.). J. Chem. Soc. 2467-71(1958) July.

The action of 200 kv x rays on dilute aerated aqueous solutions of arsenite was investigated over a wide range of pH. Arsenate is the only product in alkaline solution, but hydrogen peroxide is also formed in acid solution. A mechanism is proposed to account for the initial yields in acid solution, for the variation of initial yields with pH, and for the dependence of the yield on radiation dose. (auth)

15400

THE SZILARD-CHALMERS EFFECT ON BROMINE DERIVATIVES. II. THE CHEMICAL EFFECTS OF IRRADIATION OF PARA-DIBROMOBENZENE IN A NUCLEAR REACTOR. R. Henry, C. Aubertin, and J. Valade (Centre d'Études Nucléaires, Saclay, France). J. phys. radium 19, 548-51(1958) May. (In French)

The chemical species of radiobromine obtained from pile-irradiated p-dibromobenzene were studied. The decompositions caused by gamma radiations interfere with recoil atom chemical reactions. The abundance of oxidized or reduced free bromine and of bromine recombined in benzene or aliphatic compounds varies greatly with the gamma and neutron flux. It is concluded that only a small fraction of radiobromine (3% maximum) does not separate from the initial molecule. The primary chemical state of the recoil bromine appears to be an oxidized one, either Br^+ or Br. This bromine recombines to give non-benzenic derivatives according to the flux. A certain number of radicals exist until dissolution occurs when they give hydroxylated derivatives (about 3%). (tr-auth)

15401

ADVANCES IN NUCLEAR CHEMISTRY. A. K. Lavrukhina (Vernadski Inst. of Geochemistry and Analytical Chemistry, Moscow). Priroda No. 6, 9-18 (1958). (In Russian)

A review is given of the achievements and developments in nuclear chemistry. Nuclear reactions with slow particles, fission of heavy elements induced by slow neutrons, and preparations of new chemical elements and radioactive isotopes are discussed. (R.V.J.)

15402

RADIOLYSIS OF AQUEOUS SOLUTIONS OF GLYCINE. Boyd. M. Weeks and Warren M. Garrison (Univ. of California, Berkeley). Radiation Research 9, 291-304 (1958) Aug.

A detailed mechanism for the radiolysis of the glycine-water system is developed. The treatment is based on the various literature sources and on new experimental findings which are described. It is proposed that the indirect action of radiation on glycine in oxygen-free solution results in formation of the free-radical intermediates CH_2COOH and $NH_2CHCOOH$. Although most of these ultimately yield acetic acid and glyoxylic acid, respectively, it is concluded that some undergo radical-radical reaction to yield succinic acid, aspartic acid, and diaminosuccinic acid. Effects of oxygen, glycine concentration, and pH are discussed. (auth)

Radiation Effects

15403 AECU-3764

California Research Corp., Richmond, Calif.
DEVELOPMENT OF RADIATION RESISTANT OILS. Report No. 11. J. G. Carroll, R. O. Bolt, and S. R. Calish. June 16, 1958. 42p. Contract AT(11-1)-174.

Oils made up of alkylbenzenes, polymers and dialkyl selenide were compounded, compared with conventional mineral oils of same viscosity, and subjected to 10^{10} r gamma radiation. The results indicate promise for these materials as radiation resistant oils, with probable residual lubricity up to 10^{10} r. The conventional specification oils were changed considerably. The radiation affected the appearance, color, pour point, and viscosity of all the oils, but not the acidity or wear properties. (T.R.H.)

15404 HW-53718

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
PYROLYTIC AND RADIOLYTIC DECOMPOSITION OF ORGANIC REACTOR COOLANTS. D. R. de Halas. Nov. 25, 1957. 25p. Contract W-31-109-eng-52. $0.75(OTS).

Gamma irradiations have been conducted on monoisopropylbiphenyl. The gamma radiolysis products are similar to those formed by reactor radiations. Fast neutrons are found to be slightly more damaging per equal energy absorption than gamma rays. The pyrolysis of several polyphenyl compounds has been investigated. When the pyrolysis data are combined with previously obtained reactor radiolysis data, it is found that under irradiation all polyphenyl compounds decompose at about equal rates below a transition temperature that is characteristic of the compound. The approximate transition temperatures are: biphenyl 430°C, terphenyl 420°C, monomethylbiphenyl 400°C, and isopropylbiphenyl 370°C. (auth)

15405

CHEMICAL EFFECTS OF PHOTONUCLEAR REACTIONS IN THE PROPYL BROMIDES. A. E. Richardson and A. F. Voigt (Iowa State Coll., Ames). J. Chem. Phys. 28, 854-63(1958) May.

Two new photonuclear reactions are reported, $Br^{79}(\gamma,2n)Br^{77}$ and $Br^{79}(\gamma,3n)Br^{76}$. The organic retention following the $Br^{81}(\gamma,n)Br^{80m}$ reaction in liquid n- and isopropyl bromides was found to be 47 and 36%, respectively, appreciably higher than reported values following the $Br^{79}(n,\gamma)Br^{80m}$ reaction. Higher retentions were also noted for irradiations of the solid bromides. The relative yields of individual organic products were determined for irradiations of both liquid and solid and were in many respects in striking agreement with data from activation by (n,γ) reaction and isomeric transition. In solid n-propyl bromide the (γ,n) and $(\gamma,3n)$ reactions gave the same ratio of parent compound to total organic yield. Data on the scavenger effect show that thermal recombination reactions occur in both liquid and solid. Marked increases are shown in the thermal organic yield with only slight increases in the nonthermal retention for both bromides for (γ,n) compared to (n,γ) activation. The reasons for these increases are discussed. In general, the data indicate that elastic collision mechanisms are unimportant compared to random fragmentation as an explanation of the results. (auth)

15406

OXYGEN EFFECTS IN THE RADIATION CHEMISTRY OF POLYETHYLENE. L. E. St. Pierre and H. A. Dewhurst (General Electric Co., Schenectady, N. Y.). J. Chem. Phys. 29, 241-2(1958) July.

The effects of various pressures of O_2 from 0 to 10 atm on the radiation chemistry of polyethylene were studied. The samples were irradiated with 800-kvp electrons from a resonant transformer source at a dose rate of 8×10^{20} ev/g/min, and the amount of gel was determined by extraction to constant weight with boiling toluene. A discussion of results is presented, including a comparison with those obtained by other workers. (J.R.D.)

15407

THE EFFECT OF GAMMA IRRADIATION ON THE POTENTIAL BEHAVIOR OF PLATNIUM AND STAINLESS STEEL ELECTRODES. Walter E. Clark (Oak Ridge National Lab., Tenn.). J. Electrochem. Soc. 105, 483-5(1958) Aug.

The effect of gamma radiation on the potential of platinium and stainless steel electrodes in 0.1N sulfuric acid is reported. (auth)

Rare Earths and Rare-earth Compounds

15408

THE CONFIGURATION OF THE SOLVATE "ICEBERG" ABOUT Eu^{+3} IN AQUEOUS AND ALCOHOLIC SOLUTIONS OF $EuCl_3$. Donald G. Miller (Univ. of California, Livermore). J. Am. Chem. Soc. 80, 3576-9(1958) July 20.

Models are proposed for the close-in structure of the solvate about the trivalent europium ion in aqueous and alcoholic solutions of $EuCl_3$. These models satisfy the spectroscopic conditions that the symmetries are D_{2h} and C_{2v}, respectively, there is a single stable configuration about the ion in each case, and the close-in arrangements must be very similar. The models are the Eu^{+3} ion in an interstitial position of the ice III lattice for aqueous solutions and in alcoholic solutions a pair of hydrogen bonded alcohol chains drawn in toward the Eu^{+3} ion with possibly one or two nearby chloride ions. These models should be applicable to most of the other rare earths and smaller trivalent ions but probably not to lower valence types. (auth)

15409

FLUORESCENCE SPECTRUM AND LOW LEVELS OF $NdCl_3$. E. Carlson and G. H. Dieke (Johns Hopkins Univ., Baltimore). J. Chem. Phys. 29, 229-30(1958) July.

The absorption and fluorescence spectra of $NdCl_3$ with a dispersion of 1.2 A/mm and 5.0 A/mm, respectively, were photographed. The lines were very sharp, and good Zeeman splittings were observed. The fluorescence spectrum contains more than 200 different lines in many excitement levels. The analysis of the fluorescence spectrum makes it possible to obtain the levels of the ground multiplet for which no information was previously available. (J.R.D.)

15410

PARTIAL REVISION: ABSORPTION SPECTRUM AND QUANTUM STATES OF THE PRASEODYMIUM ION. I. SINGLE CRYSTALS OF PRASEODYMIUM CHLORIDE. Edward V. Sayre, Kenneth M. Sancier, and Simon Freed (Brookhaven National Lab., Upton, N. Y.). J. Chem. Phys. 29, 242-3(1958) July.

In an analysis of term splitting in the absorption spectrum of 24 samples of praseodymium chloride, Judd (Proc. Roy. Soc. (London) A241, 414(1957)) found all but two of the authors' results to be constant with

his. A discussion of reconciliation is presented, and the authors point out that the error is due to a mistake in descrimination between electronic transitions and the weak vibrationally coupled lines. (J.R.D.)

15411

APPLICATION OF A CALCULATED CALIBRATION CURVE IN THE SPECTRAL ANALYSIS OF THE RARE EARTH ELEMENTS BY THE METHOD OF ADDITIONS. A. I. Akimov. Optika i Spectroskopiya 2, 809-11(1957). (Translated from Referat. Zhur. Khim. No. 2, 1958, Abstract No. 4293.)

The calibration curve is calculated and plotted. In the analysis the value of the added concentration is selected so that the intensities of the lines in the spectrum of the standard and the base are not noticeably different. The use of the calibration curve is described. The method was verified by the determination of Nd in Sm in solutions. (J.S.R.)

Separation Procedures

Refer also to abstracts 16048 and 16049.

15412 AERE-C/R-545

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE SEPARATION OF ZIRCONIUM FROM HAFNIUM. II. FRACTIONAL DISTILLATION OF THE ADDITION COMPOUNDS FORMED BY PHOSPHORUS OXYCHLORIDE WITH THE TETRACHLORIDES OF HAFNIUM AND ZIRCONIUM. F. Hudswell, K. L. Wilkinson, L. J. Wyatt, and J. S. Nairn. June 1950. Decl. Aug. 14, 1958. 26p.

The preparation of the addition compounds formed by phosphorus oxychloride with hafnium and zirconium tetrachlorides is described. Partial separation of the addition compounds is effected in a specially constructed apparatus which is suitable for the fractionation of high-melting and high-boiling compounds. Zirconium oxide, containing less than 0.1% by weight of hafnium oxide, is recovered by standard methods. The process is followed by spectrographic and radioactivation methods of analysis. (auth)

15413 BNL-3746

Brookhaven National Lab., Upton, N. Y.

METHODS OF PREPARATION OF SOME CARRIER-FREE RADIOISOTOPES INVOLVING SORPTION ON ALUMINA. Walter D. Tucker, Margaret W. Greene, Allen J. Weiss, and Alex Murrenhoff. [May 29, 1958]. 8p. Contract [AT-30-2-gen-16]. $1.80(ph OTS); $1.80 (mf OTS).

Methods employing alumina as an adsorbent were developed for the separation and purification fluorine-18, molybdenum-99, technetium-99m, tellurium-132, and iodine-132. Alumina in acidic form behaves as an anion exchanger and adsorbs anions from solution, allowing cations to pass through. In the basic form it behaves as a cation exchanger and will adsorb cations and have no effect on anions. By varying the pH, different ions may be selectively eluted, depending upon how firmly they are bound to the alumina. Relatively small volumes of reagents are required, and rapid separation may be effected. (C.H.)

15414 CF-58-7-98

Oak Ridge National Lab., Tenn.

THE PROBLEM OF SCRUBBING THE HYDROFLUORINATION OFF GAS WITH LIQUID HF. M. E. Whatley and L. E. McNeese. July 11, 1958. 17p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

Radioactive solids will be entrained by the off-gas from the hydrofluorination step of the Volatility Process. The Volatility Process is being developed as a method for recovering uranium from zirconium matrix fuel elements. It is proposed to scrub these solids from the off-gas in a packed bed using refluxed liquid HF. A development program has been planned and a unit designed for the experimental studies. (auth)

15415 COO-246

Case Inst. of Tech., Cleveland and Grace (W. R.) and Co. Washington Research Center, Clarksville, Md.

PURIFICATION BY PRECIPITATION. Louis Gordon and Murrell L. Salutsky. Aug. 4, 1958. 14p. Contract AT(11-1)-582. $3.30(ph OTS); $2.40(mf OTS).

Precipitation remains one of the most important of separation methods even though many other kinds of separation techniques have been discovered. Precipitation processes are characterized by simplicity of operation, efficiency of single-stage separation, and adaptability to large-scale procedure. Conventional precipitation methods do not permit the full realization of the separation potential inherent in precipitation processes. However, utilization of the technique of precipitation from homogeneous solution permits a greater realization of this potential. Some aspects of the technique are described. Although the problem of efficient separation by a simple multi-stage solid-liquid phase process has been solved in the case of zone-melting and ion-exchange chromatography, it has not been solved for simple precipitation. Several possible means of effecting a simple multi-stage precipitation process are considered. (auth)

15416 HEC-82

Hooker Electrochemical Co., Niagara Falls, N. Y.

BORON ISOTOPE ENRICHMENT: PILOT PLANT PROPOSAL FOR THE ANISOLE–BF_3 SYSTEM. Kenneth O. Hambrock and George T. Miller. Dec. 23, 1957. 59p. Contract AT(30-1)-1524.

This proposal for a pilot plant is based on laboratory and pilot plant work on the anisole–BF_3 system for separating boron isotopes 10 and 11. The proposal includes a flow diagram, description of the system components, instrumentation and controls, and operational procedure, and a suggested experimental program, as well as a preliminary cost estimate. The total estimated cost is $40,000 for a 6 month program provided it is integrated with the present operating facilities. Drawings and data are given for construction of the pilot plant. (auth)

15417 IDO-14439

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

FISSION PRODUCT RUTHENIUM VOLATILITY IN A HIGH TEMPERATURE PROCESS. C. E. May, B. J. Newby, K. L. Rohde, and B. D. Withers. July 1, 1958. 51p. Contract AT(10-1)-205. $1.50(OTS).

A study has been completed of the behavior of fission product ruthenium during the calcination of an aluminum nitrate–nitric acid raffinate at 400°C. The degree of volatility of the ruthenium as well as the effect of nitrate pretreatment of aqueous feed, dilution of the nitrate content of the feed, and drastic reduction of the oxidizing power of the calciner atmosphere on the volatility have been defined. Several types of bench-scale calciners were used with aqueous feeds of actual processing plant raffinate or synthetic raffinates traced with ruthenium from the plant raffinates. It has been found that, with raffinates of 1.6M aluminum nitrate and 1.0M nitric acid calcined at 400°C, about 90% of the

ruthenium is volatile. Pretreatment with 0.1 or 1.0M nitrite ion was inadequate to inhibit the very significant volatility of the ruthenium. Similarly dilution of the aqueous feed with water, with the resultant minor reduction in the oxidizing power of the calciner atmosphere, was also ineffective in inhibiting ruthenium volatility. The presence of an excess of nitric oxide in the calciner atmosphere greatly reduced the volatility of the ruthenium. In the latter case, the oxygen concentration was reduced to 0.01 mole %. Increasing the calcination temperature from 400 to 550°C also reduced the apparent ruthenium volatility. (auth)

15418 ORNL-2550
Oak Ridge National Lab., Tenn.
EQUIPMENT DECONTAMINATION METHODS FOR THE FUSED SALT--FLUORIDE VOLATILITY PROCESS. R. L. Jolley, R. D. Baybarz, D. O. Campbell, and G. I. Cathers. Sept. 10, 1958. 15p. Contract W-7405-eng-26. $0.50(OTS).

The decontamination methods studied included barren salt flushes, 0.5 M ammonium oxalate solution, 5 wt. % nitric acid—5 wt. % aluminum nitrate solution, and 10 wt. % sodium hydroxide—2.5 wt. % hydrogen peroxide—10 wt. % sodium tartrate solution. Salt flushes were relatively ineffective for decontamination, their effect being mainly dilution of residual salt. Ammonium oxalate solutions at 90 to 100°C dissolved $NaF-ZrF_4$ (50-50 mole %) and removed much activity. The nitric acid–aluminum nitrate solution was required to remove a metallic scale formed in inconel equipment as the result of contact with HF, F_2, and UF_6 at 600°C. The alkaline-peroxide-tartrate solution was particularly effective in decontaminating descaled reactors and equipment exposed to gaseous reactants and products of the fluoride volatility process. Some application of the principles involved in the decontamination procedures appears possible in other fused salt projects, for example, in molten salt reactor technology. (auth)

15419 RMO-2679
Nevada. Univ., Reno. Mackay School of Mines.
DEVELOPMENT OF ORGANIC COLLECTORS FOR THE FLOTATION OF URANIUM MINERALS. R. J. Morris, H. P. Ehrlinger, III, and J. N. Butler. Dec. 10, 1954. Decl. July 7, 1958. 43p. (UN-TR-4). $7.80(ph OTS); $3.30(mf OTS).

A series of organic reagents for the collection and flotation of several secondary uranium minerals has been developed, this being the mono-alkyl nitrogen substitutions of the dithiocarbamate grouping with a chain length of at least eight carbon atoms. In flotation tests, using the potassium salt of n-decyl dithiocarbamate as collector, high recoveries of autunite have been obtained from mixtures of finely-ground synthetic autunite and silica sand. Certain base-metal salts added as conditioning agents have increased the collecting properties and selectivity of the dithiocarbamates in the flotation of both autunite and carnotite. In single batch and locked tests, using lead as the base metal ion, recoveries of over 95 percent of the uranium have been obtained, with ratios of concentration as high as 13:1. Preliminary tests on natural ores show encouraging results; the problems of liberation and conditioning must be solved for each ore. (auth)

15420 WIN-102
National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.
A CONTINUOUS COUNTERCURRENT RESIN-IN-PULP PROCESS. J. B. Breymann, E. T. Hollis, and J. T. Lynch. July 18, 1958. 33p. Contract AT(49-6)-924. $6.30(ph OTS); $3.00(mf OTS).

Data are reported for a continuous 1375 pound per day pilot plant run of a countercurrent resin-in-pulp process using air agitated tanks and conventional vibrating screens in the adsorption circuit and continuous countercurrent column elution in the recovery circuit. Some data are given to indicate the physical stability of various anion exchange resins in use in this type of process. (auth)

15421 WIN-105
National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.
LABORATORY INVESTIGATION OF SINGLE-STAGE AND CONTINUOUS COUNTERCURRENT ION EXCHANGE METHODS. E. T. Hollis and R. J. Woody. July 1, 1958. 36p. Contract AT(49-6)-924. $6.30(ph OTS); $3.00(mf OTS).

The initial stages of the development of methods of continuous ion exchange processes are described including a combination of two stage leaching and recovery of uranium in a single stage resin-in-pulp contact, elution of uranium in a continuous countercurrent column, and exhaustion of uranium from leach liquor in the continuous countercurrent column. Test results are also presented on the effect of variables on resin loading and uranium recovery by single stage contact for solution to resin ratios in the range of 25 to 100. (auth)

15422 WIN-110
National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.
ALKALINE LEACH–FILTRATION PILOT PLANT TESTING OF PHILLIPS PETROLEUM COMPANY ORE. H. E. Dixon and G. Winslow. July 1, 1958. 54p. Contract AT(49-6)-924. $9.30(ph OTS); $3.60(mf OTS).

Phillips Petroleum Company ore from the Ambrosia Lake district of New Mexico was treated in the Alkaline Leach–Filtration Pilot Plant at Grand Junction, Colorado. Detailed information on grinding, leaching, filtration, and precipitation in connection with the processing of this ore is given. Both pressurized and atmospheric Pachuca leaching followed by filtration and continuous yellow cake precipitation were employed. The results show that the ore was amenable to the Alkaline Leach–Filtration Process. (auth)

15423
COPRECIPITATION OF RARE EARTH IODATES WITH THORIUM IODATE PRECIPITATED FROM HOMOGENEOUS SOLUTION. Kenneth J. Shaver (Monsanto Chemical Co., Miamisburg, Ohio). Anal. Chem. 28, 2015-19(1956) Dec.

The separation of thorium from rare earths by precipitation of thorium iodate from homogeneous solution is evaluated. The extent of coprecipitation is given when thorium is precipitated in the presence of the rare earths lanthanum, praseodymium, promethium, and europium, and the related elements, yttrium and scandium. The extent of coprecipitation is determined by the use of radioactive tracers of these elements. The distribution of rare earths with thorium follows the logarithmic or heterogeneous distribution law. It is concluded that trivalent rare earths coprecipitate with thorium iodate by a type of isomorphous replacement within the thorium iodate lattice. A correlation is given between ionic radii and extent of coprecipitation. (auth)

15424
SEPARATION OF ZIRCONIUM AND HAFNIUM BY RECTIFICATION METHOD. L. A. Nisel'son (Moscow

Inst. of Non-Ferrous Metals and Gold). Avtref. Diss. Kand. Tekh. Nauk Moscow Inst. Tsvetnykh Metal. i Zolta (1956). (Translated from Referat. Zhur. Khim. No. 8, 1957, Abstract No. 27408 D.)

15425

FLOCKING SLIMES INCREASES URANIUM OUTPUT. POLYACRYLAMIDE FLOCCULATING AGENTS BREAK BOTTLENECK IN URANIUM LEACHING FOR U. S. AND CANADIAN MILLS. Ind. Eng. Chem. 50, No. 8, 42A(1958) Aug.

Present processes for extracting uranium from ore involve grinding the ore under water. The resulting colloidal mineral dispersions must at some stage be flocculated and filtered. The most troublesome dispersions consist of small particles mostly 1 to 10 μ in diam., which do not filter. Vinyl and polyacrylamide polymers, when combined with these dispersions, produce a porous, easily filterable floc. A maximum addition of the flocculant was determined above which a redispersion is effected, thus causing filter pore clogging. (J.R.D.)

15426

ATOMIC FUELS AND FISSION PRODUCTS. Per Gustavson. Kem. i ind. (Zagreb) 5, No. 10, 247-69 (1956). (Translated from Referat. Zhur. Khim. No. 9, 1957, Abstract No. 31206.)

A review is presented of the methods used for processing raw materials for U and Th and the processing of fission products. The use of fission products in the chemical industry and in other branches of science and engineering is discussed. 13 references. (J.S.R.)

15427

THE PRINCIPLES OF HIGH TEMPERATURE FUEL PROCESSING. F. S. Martin and G. L. Miles (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Progr. Nuclear Energy, Ser. III, Process Chem. 1, 291-300(1956).

The problems of processing metallic reactor fuels are discussed in relation to the separation of fission products and fissile material from spent reactor fuel. It is shown, from thermodynamic considerations, that most of the fission products which are important from the point of view of neutron capture can be removed without destruction of the metal. (auth)

15428

THE TREATMENT OF RUTHENIUM-RICH RADIOACTIVE EFFLUENTS BY SULPHIDE PROCESSES. F. S. Martin and G. L. Miles (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Progr. Nuclear Energy, Ser. III, Process Chem. 1, 369-76(1956).

It has been shown that fission product ruthenium can be removed from solutions which are representative of solvent-process solutions and plant effluents sulfide, by coprecipitation of nitrosylruthenium hydrosulfide with other acid-insoluble sulfides. Alternatively, fission product ruthenium may be adsorbed by passing the fission product solution through a bed of, for example, antimony sulfide. Under suitable conditions over 99% of the ruthenium can be removed by these treatments. (auth)

15429

PAPER CHROMATOGRAPHIC ANALYSIS OF SELENIUM, TELLURIUM, POLONIUM, AND BISMUTH. Carl E. Crouthamel and Christopher Gatrousis (Argonne National Lab., Lemont, Ill.). Talanta 1, 39-40(1958).

The chromatographic analysis of Po^{210}, Bi^{210}, $Te^{127,129}$, and Se^{75} in hydrochloric acid and hydrofluoric acid developing media is described. This method of isolation of Po^{210} from bismuth targets gives in a single operation clean samples at 100% yield. The solutions of Po^{210} were obtained in very small volume and were suitable for high resolution α-pulse analysis. (auth)

15430

STUDY ON MOLYBDENUM AND RHENIUM SORPTION ON 10 ANIONITE FROM VARIOUS MEDIUMS AND CHROMATOGRAPHIC SEPARATION OF THESE ELEMENTS. D. I. Ryabchikov and L. V. Borisova (Vernadskii Inst. of Geochemistry and Analytical Chemistry, Academy of Sciences, USSR). Zhur. Anal. Khim. 13, 155-61(1958) Mar.-Apr. (In Russian)

The distribution of rhenium and molybdenum between anionite and HCl, HNO_3, H_2SO_4 and H_3PO_4 solutions was studied under static conditions with the use of radioactive isotopes, Re^{186} and Mo^{99}. The difference in rhenium and molybdenum sorption from a phosphoric acid medium may be explained by the formation of a complex molybdenum anion which is well detained by active resin groups. The separation of various synthetic mixtures of rhenium and molybdenum was accomplished under dynamic conditions. 2 M H_3PO_4 was used for washing out rhenium, whereas molybdenum was washed with 10% solution of NaOH. The method is suitable for the isolation of rhenium from molybdenite and technetium from irradiated molybdenum samples. (tr-auth)

15431

SEPARATION OF THORIUM FROM RARE EARTHS BY MEANS OF PYRIDINE AND ITS NITRATE. E. A. Ostroumov. Zhur. Anal. Khim. 13, 201-5(1958) Mar.-Apr. (In Russian)

Thorium is quantitatively precipitated by means of a mixture of pyridine and its nitrate at pH 4.1 to 4.2. The coagulation and settling of the precipitate can be speeded up by ammonium nitrate. Thorium hydroxide precipitates in a very compact state and has little absorptive capacity. Yttrium, lanthanum, trivalent cerium, neodymium, praseodymium, erbium, samarium, and ytterbium stay in the solution. The separation of thorium is complete and does not require reprecipitation. (tr-auth)

Sorption Phenomena

15432

RADIOACTIVE TRACER STUDY OF THE ADSORPTION OF PHOSPHATE IONS BY ALUMINIUM OXIDE. K. R. Kar (Delhi Univ.). J. Sci. Ind. Research (India) 17B, 175-8(1958) May.

With a view to elucidate the nature of the adsorption of orthophosphate ions on aluminum oxide, the exchange kinetics of these ions between (1) phosphatized (tagged with P^{32}) alumina and inactive sodium phosphate in solution, and (2) solid aluminum phosphate (tagged with P^{32}) and inactive sodium phosphate in solution were studied. From the observed difference in the half times of exchange in the two cases, i.e., 7·5 in the case of (1) and 18 min. in the case of (2), it is concluded that the adsorption of phosphate ions on alumina is different from the chemical binding between aluminum and phosphate radicals in solid aluminum phosphate. There is, however, evidence to indicate that the rapid process of adsorption of phosphate ions on aluminum oxide is followed by a relatively slow process of diffusion of the phosphate ions into the interior of the microcrystals of aluminum oxide. (auth)

Spectroscopy

15433 AEC-tr-3344

RAMAN SCATTERING OF LIGHT BY SUBSTANCES IN THE LIQUID AND VITREOUS STATES. E. F. Gross and V. A. Kolesova. Translated by Oak Ridge National Lab. Library Staff from Pamyati Sergeya Ivanovicha Vavilova, Akad. Nauk S.S.S.R., 231-8(1952). 11p.

The Raman spectra of nitric acid and phosphoric acid glasses were investigated in both the vitreous and liquid states. Tables were prepared showing line widths and frequencies. (D.E.B.)

15434

ELECTRON PARAMAGNETIC RESONANCE SPECTRA OF BIOLOGICAL OBJECTS. I. ACTION OF IONIZING RADIATION ON DRY AMINO ACIDS, PEPTIDES, PROTEINS AND LYOPHILIZED TISSUES. L. A. Blyumenfel'd and A. E. Kalmanson (Biological Sciences Section, Academy of Sciences of the USSR, Moscow). Biophysics (USSR) (English Translation) 2, 546-58(1958).

The electron paramagnetic resonance spectra of irradiated dry amino acids, peptides, proteins, and lyophilized tissues were studied. Results indicate that electronic levels common to the whole molecule exist in proteins. (C.H.)

15435

SUBSTITUTED METHANES. XXVIII. INFRARED SPECTRAL DATA AND ASSIGNMENTS FOR $CHCl_2F$ AND $CHClF_2$ AND POTENTIAL ENERGY CONSTANTS AND CALCULATED THERMODYNAMIC PROPERTIES FOR $CHCl_2F$, $CDCl_2F$, $CHClF_2$, AND $CDClF_2$. Herman B. Weissman, Arnold G. Meister, and Forrest F. Cleveland (Illinois Inst. of Tech., Chicago). J. Chem. Phys. 29, 72-7(1958) July.

Infrared spectral data were obtained with NaCl and CsBr prisms for gaseous $CHCl_2F$ and $CHClF_2$ from 270 to 4000 K (K = kayser = wave/cm) and the observed absorption bands were assigned to the vibrational modes for both molecules. Using the Wilson FG matrix method, reasonable values of the F-matrix elements were found which reproduced the observed wave numbers to within 2%. These were then used to calculate the wave numbers corresponding to the fundamental vibrations of $CDCl_2F$ and $CDClF_2$. Also, these F-matrix elements and analytical expressions obtained from the theory of Gold, Dowling, and Meister were used to get values of the f-matrix elements (potential energy constants). Having tested the assignments by the normal coordinate treatments, the observed wave numbers for $CHCl_2F$ and $CHClF_2$ were then used to calculate the enthalpy function, the free energy function, the entropy, and the heat capacity for 1 atmos pressure and for 12 temperatures from 100 to 1000°K, to a rigid rotor, harmonic oscillator, ideal gas approximation. Since the calculated wave numbers for $CDCl_2F$ and $CDClF_2$ should be reliable to within about 2%, these were used in similar thermodynamic calculations to establish tentative values of the thermodynamic functions for these molecules. (auth)

15436

INFRARED SPECTRA OF THE ALKALINE-EARTH HALIDES. I. BERYLLIUM FLUORIDE, BERYLLIUM CHLORIDE, AND MAGNESIUM CHLORIDE. Alfred Büchler and William Klemperer (Harvard Univ., Cambridge, Mass.). J. Chem. Phys. 29, 121-3(1958) July.

The infrared spectra of BeF_2, $BeCl_2$, and $MgCl_2$ in the vapor phase have been measured. Both the asymmetric stretching mode ν_3 and the bending mode ν_2 were observed for each of these compounds. The observed frequencies are

	BeF_2	$BeCl_2$	$MgCl_2$
ν_3	1520	1113	597 cm^{-1}
ν_2	825	482	295

Two bands of the gaseous dimer Be_2Cl_4 were also observed. Examination of the bending force constants shows that the bonds in the dihalides are strongly directional. The bond stretching force constants of these dihalides are almost identical in magnitude with those of the corresponding monohalides BeF, BeCl, and MgCl. (auth)

15437

FLUORESCENCE SPECTRA, TERM ASSIGNMENTS, AND CRYSTAL FIELD SPLITTINGS OF RARE EARTH ACTIVATED PHOSPHORS. Seymour P. Keller (IBM Corp., Poughkeepsie, N. Y.). J. Chem. Phys. 29, 180-7(1958) July.

The visible fluorescent emissions, excited by 280-mμ radiation, of SrS phosphors, singly activated with rare earth ions, have been determined. These spectra are correlated with atomic term signature designations and with spectra of rare earth salt compounds. Crystal field splittings of certain energy levels are observed. (auth)

Syntheses

15438 NP-6927

Du Pont de Nemours (E. I.) & Co. Eastern Lab., Gibbstown, N. J.

RESEARCH ON SYNTHESIS OF 1000 DEGREES F. STABLE BASE FLUIDS. Progress Report No. 1 [for] June–August 1958. J. A. Parkins. Sept. 15, 1958. 13p.

Initial attempts to synthesize fluids stable at high temperatures are reported. The phosphorus chloronitride $(PNCl_2)_n$ system was studied, and a procedure to treat the system to increase the quantity of liquid fractions was devised. Attempts at replacement of the chlorine of $(PNCl_2)_n$ with fluorine by reaction with sodium fluoride resulted in incomplete substitution. The arsenic and antimony analogs could not be prepared by the standard method used for $(PNCl_2)$ or by two variations attempted. The modification of molten boric oxide glass during shear has been beset with mechanical difficulties. The preparation of a "stiboxane" from antimony oxide was unsuccessful. The oily methyl ester of cacodylic acid ($(CH_3)_2AsOOCH_3$) has been prepared but incompletely characterized. (auth)

Transuranic Elements and Compounds

15439 AERE-C/M-80(Rev.)

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE FLUORIDE–HYDROXIDE CYCLE IN THE PURIFICATION OF PLUTONIUM. J. K. Dawson and R. Hurst. 1957. Date of MS. Aug. 1950. Decl. with amendment Nov. 13, 1956. 5p. $0.24(BIS).

The results of the purification of plutonium solutions by means of a potassium plutonium fluoride–plutonium hydroxide cycle are reported. The method gives good separation from uranium, iron, and chromium. (auth)

15440 AERE-C/R-2388

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE CO-PRECIPITATION OF SMALL AMOUNTS OF PLUTONIUM ON LANTHANUM FLUORIDE IN THE PRESENCE OF URANIUM. G. N. Walton, E. Furby, and Valerie Owen. 1958. Date of MS. Feb. 1951. Decl. Mar. 1957. 27p. $0.72(BIS).

Declassified version of AERE-C/R-670.

Extraneous α activity carried down during the estimation of low counts of plutonium in the presence of uranium by the lanthanum fluoride co-precipitation technique, was investigated. Failure to eliminate this α activity is shown to be due to the adsorption of micro-gram amounts of uranyl ions by the precipitate in such a manner that they cannot readily be washed off. The percentage adsorbed increased, the lower the concentration of uranyl ion involved. (auth)

15441

THE HEAT OF SOLUTION OF PLUTONIUM TRICHLORIDE. P. E. Martin and A. G. White (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Chem. Soc. 2490-2(1958) July.

The heat of solution of anhydrous plutonium trichloride in aqueous perchloric acid and in perchloric acid–lithium perchlorate solutions at constant ionic strength was measured. The results provide further evidence for the formation of a chloride complex by the tervalent plutonium ion and an approximate value for the change of heat content accompanying its formation was calculated. (auth)

15442

PHYSICO-CHEMICAL PROPERTIES OF PLUTONYL FLUORIDE. I. F. Alenchikova, L. L. Zaitseva, et al. Zhur. Neorg. Khim. 3, 951-5(1958) Apr. (In Russian)

A method is offered for the synthesis of plutonyl fluoride by precipitation from hydrochloric acid solutions of hexavalent plutonium by liquid hydrogen fluoride. The properties of plutonyl fluoride were investigated, and chemical analysis determined its composition as PuO_2F_2. (R.V.J.)

15443

PHYSICO-CHEMICAL PROPERTIES OF PLUTONIUM(IV) OXALATE AND DETERMINATION OF THE SOLUBILITY PRODUCT. A. I. Moskvin and A. D. Gel'man (Inst. of Physical Chemistry, Academy of Sciences, USSR). Zhur. Neorg. Khim. 3, 956-61(1958) Apr. (In Russian)

The solubility of $Pu(C_2O_4)_2 \cdot 6H_2O$ in water, H_2SO_4, HNO_3, and $HClO_4$ was measured. The solubility product of $Pu(C_2O_4)_2 \cdot 6H_2O$ in perchloric acid and mixed solutions of $HNO_3-(NH_4)C_2O_4$ was equal to 4×10^{-22}. (R.V.J.)

15444

DETERMINATION OF THE COMPOSITION AND INSTABILITY CONSTANTS OF OXALATE AND CARBONATE COMPLEXES OF PLUTONIUM IV. A. I. Moskvin and A. D. Gel'man (Inst. of Physical Chemistry, Academy of Sciences, USSR). Zhur. Neorg. Khim. 3, 962-74 (1958) Apr. (In Russian)

Determination was made of $Pu(C_2O_4)_2 \cdot 6H_2O$ solubility in various concentrations of ammonium oxalate solutions (0.001 to 0.35 mol/l) in the presence of 1.0 mole HNO_3 and $Pu(OH)_4$ solubility in various concentrations of K_2CO_3 aqueous solutions. The increased solubility of $Pu(OH)_4$ in solutions with higher concentrations of K_2CO_3 was considered the result of Pu^{4+} complex formation with carbon ions. This was confirmed by the characteristics of the absorption spectra of Pu^{4+} solutions. The tendencies of plutonium, at various degrees of oxidation, to complex with oxalate ions and of Pu^{4+} with anions of some acids were investigated. (R.V.J.)

15445

PLUTONIUM SALICYLATES. O. E. Zvyagintsev and B. N. Sudarikov. Zhur. Neorg. Khim. 3, 975-85(1958) Apr. (In Russian)

Analysis was made of the behavior of Pu^{3+} and Pu^{4+} salts in solutions of salicylic acid and ammonium salicylates. It was found that in a weak acid media Pu^{4+} forms salicylate $PuO(Sal^-)_2$, while Pu^{3+} precipitates as $Pu^{3+}(Sal^-)_3 \cdot 1.5H_2O$. Both Pu^{3+} and Pu^{4+} form a complex anion, $PuO(Sal^{2-})_2$, when titrated in ammonium and alkali solutions. It was also shown that with heating, Pu^{4+} oxysalicylate precipitates from ammonium solutions of Pu^{3+}, Pu^{4+}, and Pu^{6+}. Optimum conditions of plutonium oxysalicylate precipitation were determined. (R.V.J.)

Uranium and Uranium Compounds

Refer also to abstract 16047.

15446 CRFD-757

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

COMPARISON OF BINDER/LUBRICANT ADDITIVES IN DRY PRESSING URANIUM DIOXIDE POWDER. E. Mizzan and G. H. Chalder. June 1958. 18p. (AECL-660). $0.50(AECL).

A total of 21 commercial binder/lubricants were compared with paraffin wax for use as a binder addition in the fabrication of cylindrical uranium dioxide pellets by the cold pressing and hydrogen sintering technique. Carbowax 4000 gave the best over-all results and together with Mobilcer R compared favorably with paraffin wax. Camphor and Mobilcer X were very good, but gave slightly lower sintered densities. The remaining binders were inferior to paraffin wax under the conditions studied. The supplementary addition of very small amounts of Sterotex as an internal die lubricant generally resulted in improved density and quality of the sintered pellets. (auth)

15447 HW-51748

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

FABRICATION BEHAVIOR OF SOME URANIUM DIOXIDE POWDERS. D. R. Stenquist and R. J. Anicetti. Dec. 1, 1957. 25p. Contract W-31-109-Eng-52. $0.75 (OTS).

The physical characteristics of uranium dioxide powders depend not only upon how they are prepared, but also upon the treatment of the powders prior to fabrication. Preliminary attempts to produce high-density sintered UO_2 bodies demonstrated a wide range of sinterability among UO_2 powders having different physical characteristics. Sintered densities of various UO_2 powders varied from 80 to 97% of the theoretical density, even though identical forming and sintering procedures were used. The objectives of this investigation were to determine the effect of powder characteristics on the fabrication of stoichiometric UO_2, and to devise methods of increasing the density of UO_2 powders which are sintered in hydrogen. (auth)

15448 KAPL-1664

Knolls Atomic Power Lab., Schenectady, N. Y.

A STUDY OF THE INTERACTION OF BARIUM METAL

AND BARIUM OXIDE WITH URANIUM DIOXIDE. S. C. Furman. Jan. 1, 1957. Changed from OFFICIAL USE ONLY Aug. 26, 1958. 13p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

The compound, barium uranite ($BaUO_3$), has been prepared by the reaction of Ba and UO_2 to produce barium uranite and uranium metal, and by the reduction of barium uranate ($BaUO_4$) by hydrogen at 800°C. The crystal structure observed agrees with that reported by others. The compound is stable in air and shows promise as a reactor fuel. (auth)

15449 SCNC-257

Sylvania-Corning Nuclear Corp., Bayside, N. Y.

REACTIVITY OF CERTAIN URANIUM OXIDES WITH ALUMINUM. Terminal Report. A. L. Eiss. Feb. 10, 1958. 26p. Project 1948. Contract AT-30-1-GEN-366.

The reaction between uranium dioxide and aluminum has been studied at 600°C and below. At 600°C the visible reaction occurred within a few hours, while, for example, at 500°C and below, the specimens had to be at temperature for several days in order to show signs of any reaction. The method of manufacture of uranium dioxide had a pronounced effect on its compatibility. Granulated and high-fired oxides showed lowest, and the steam-treated oxide showed maximum, reactivity. The fact that finer oxide powder particles react faster than coarse ones was according to expectations. Mallinckrodt U_3O_8 powder of very fine particle size reacted severely with aluminum during a $1\frac{1}{2}$-hr test at 610°C. (auth)

15450

AN X-RAY STUDY OF ALKALI METAL URANATES. L. M. Kovba, E. A. Ippolitova, Yu. P. Simanov, and V. I. Spitsyn (Lomonosov Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 120, 1042-4(1958) June 11. (In Russian)

X-ray studies were made of the prepared mono- and diuranate alkali elements of: $\alpha-Li_2UO_4$, $\alpha-Na_2UO_4$, $\beta-Na_2UO_4$, K_2UO_4, Rb_2UO_4, Cs_2UO_4, $Na_2U_2O_7$, $K_2U_2O_7$, and $Rb_2U_2O_7$. The magnitudes of lattice parameters, densities, spatial groups, and structure data are tabulated. (R.V.J.)

15451

DISSOLUTION OF URANIUM FROM FRENCH MINERALS BY OXIDIZING ATTACK. A. Graire. Énergie nucléaire 2, 116-19(1958) Apr.-June. (In French)

The dissolution of uranium from pitchblende minerals is generally done by sulfuric oxidizing attack, the oxidant consisting either of pyrolusite, ferric sulfate, or nitrates or chlorates. In all cases, ferric sulfate seems to be the intermediate compound of the dissolution reaction. A certain analogy can then be recognized between the attack on the French pitchblendes and the recovery of copper from the cuprous pyrites of southern Spain. The leaching methods with ashes seem then directly applicable to uranium treatment. For uranium, as for copper, the length of leaching, the temperature, and the concentration in Fe^{3+} constitute the principal factors in dissolution. (tr-auth)

15452

NONSTOICHIOMETRY IN URANIUM DIOXIDE. S. Aronson and J. Belle (Westinghouse Electric Corp., Pittsburgh). J. Chem. Phys. 29, 151-8(1958) July.

A thermodynamic study of the uranium–oxygen system, primarily in the single phase region $UO_2-UO_{2.20}$, has been made at temperatures of 1150° to 1350°K. An electrochemical technique was used to obtain emf measurements on uranium oxide half-cells. The cells were of the type Fe, $FeO|(ZrO_2 + CaO)|UO_{2+x}$, Pt where x varied from 0.01 to 0.20. Partial molar free energies, entropies, and enthalpies of solution of oxygen in UO_{2+x} were calculated. The partial molar free energy is a linear function of temperature at constant composition. The partial molar entropy increases negatively with increasing oxygen content. Equations relating the thermodynamic quantities to the degree of nonstoichiometry have been developed on the assumption that the UO_{2+x} region can be treated as an interstitial solution of oxygen ions in the UO_2 fluorite lattice. Semiquantitative agreement with the data was obtained. (auth)

15453

THE OXIDES OF URANIUM. PART IX. THE DECOMPOSITION OF CARBON MONOXIDE ON URANIUM AND THORIUM DIOXIDES. L. E. J. Roberts, A. J. Walter, and V. J. Wheeler (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Chem. Soc. 2472-81 (1958) July.

The decomposition of carbon monoxide, yielding carbon and carbon dioxide, takes place much faster on urania than on thoria at 500 to 900°. Carbon is deposited on urania up to a limit which depends on the surface area of the urania but not on temperature. The chemisorptive capacity of urania for oxygen is decreased and oxygen is lost from the solid oxide as carbon is deposited. The addition of a little carbon dioxide to the carbon monoxide is sufficient to inhibit the decomposition; carbon dioxide is chemisorbed on urania below 200°. (auth)

15454

THE PROCESSING OF IRRADIATED URANIUM BY HIGH TEMPERATURE OXIDATION REACTIONS. F. S. Martin and G. L. Miles (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Progr. Nuclear Energy, Ser. III, Process Chem. 1, 329-41(1956).

Experimental results are presented for various slagging processes, for chlorination treatments, and for the electrolysis of uranium in fused chloride media. The possible mechanism of the slagging process is considered in relation to the impurity and fission product content of the uranium. (auth)

15455

COLOR REACTION FOR URANIUM WITH ARSENAZO. V. I. Kuznetsov (V. I. Vernadskii Inst. of Geochemistry and Analytical Chemistry, Moscow). Zhur. Anal. Khim. 13, 220-4(1958) Mar.-Apr. (In Russian)

When dissolved in water, arsenazo –0-(1.8-dihydroxy-3.6-disulfo-2-naphthyl-azo)-benzenarsonic acid gives a red-pink color which in the presence of uranium changes into a blue color (hexavalent uranium, pH 4.5—5.5) or a violet color (tetravalent uranium, a mineral acid medium). U^{6+} is detected by adding arsenazo and urotropin in the weak acid solution under investigation. The limiting dilution for uranium is 1 in 5×10^6. When H_2O_2 is added the colors instantly change to pink (a control reaction). By using NaF, $Na_2S_2O_3$ and salicylates for masking, U^{6+} can be detected in the presence of rare earths, Fe, Al, Th, Zr, Cu, Be. Tetravalent uranium in a mineral acid medium can be directly determined in the presence of large quantites of U^{6+}, rare earths, V^{4+}, Be, Al, Fe^{4+}, Cu, Mg, and a number of other elements. Interfering cations (Fe^{3+}, Zr, Ti, Th) and anions (phosphates, arsenates) can be separated by co-precipitating them with metastannic acid which precipitates on the hydrolysis of $SnCl_4$ solution added. Techniques are described of a quantitative reaction for U^{6+}, and U^{4+} and of detecting U^{6+} and U^{4+} in minerals. (tr-auth)

15456

ISOCONCENTRATES OF $UO_2(NO_3)_2-NH_4NO_3-HNO_3-(C_2H_5)_2O-H_2O$ SYSTEM. A. V. Nikolaev and A. G. Kurnakova. Zhur. Neorg. Khim. 3, 1037-43(1958) Apr. (In Russian)

Diagrams were plotted for quadruple systems $UO_2(NO_3)_2-NH_4NO_3-H_2O-(C_2H_5)_2O$ at 25°C in rectangular coördinates (showing the aqueous systems in rectangular coördinates and the ether system plotted as equilibrium magnitudes of distribution constants) for the total field of aqueous solutions. An isoconcentrate diagram of 1.5N HNO_3 for the quintuple system $HNO_3-NH_4NO_3-UO_2(NO_3)_2-H_2O-(C_2H_5)_2O$ is included. It is shown that nitric acid with a salting out reagent increases the extraction. (R.V.J.)

Waste Disposal

15457 CRER-792

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

CHEMICAL INVESTIGATIONS OF THE MOVEMENT OF FISSION PRODUCTS IN SOIL. E. J. Evans. Aug. 1958. 24p. (AECL-667). $0.50(AECL).

The movement of radionuclides in dilute and concentrated liquid wastes in the soil at Chalk River is presented. The two types of waste considered are low level and intermediate level wastes. (W.L.H.)

15458 IDO-14440

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

LEACHING OF FISSION PRODUCTS FROM CALCINED PROCESS WASTE. M. E. McLain and D. W. Rhodes. Apr. 30, 1958. 29p. Contract AT(10-1)-205. $1.00 (OTS).

Samples of aluminum nitrate-fission product waste which contained one volume of radioactive ICPP waste to 500 volumes of synthetic waste were prepared at Argonne National Laboratory by fluid bed calcination at 400°C. Samples of the calcined product were leached with 0.5M nitric acid solution to remove the heat producing and long-lived fission products. Greater than 90% of the cesium-137, approximately 67% of the strontium-90, and 9% of the cerium-144 were removed from the calcined solid by six successive extractions at 25°C. In addition, 15 to 20% of the initial solids, constituting all of the sodium nitrate and part of the aluminum oxide, were dissolved during leaching. An attempt was made to leach ruthenium-106, zirconium-95, and plutonium-239 from alumina samples prepared by calcining at 550°C, one volume of ICPP waste diluted with 100 volumes of synthetic waste. Less than 20% of the ruthenium-106 and 10% or less of the zirconium-95 and plutonium-239 were removed by six successive extractions. Ignition data indicated that cesium-137 volatilized appreciably between 800 and 1100°C. In general, only about 10 to 20% of the heat producing fission products in 120-day cooled waste appeared to be readily extractable by leaching. The principal effect of the leaching process appeared to be removal of long-lived fission products to reduce somewhat the need for long term cooling; however, a potential does exist for the recovery of cesium-137 and strontium-90 from calcined alumina, provided further purification can be accomplished economically. (auth)

15459 NAS-NRC/Pub-588

Harvard Univ., Cambridge, Mass.

THERMAL CONSIDERATIONS IN DEEP DISPOSAL OF RADIOACTIVE WASTE. Francis Birch. July 1958. 24p. For National Research Council. Committee on Waste Disposal. Contract AT(30-1)-1788. $1.00(NAS-NRC).

The safety problem with relation to heat generation in the disposal of large quantities of radioactive waste to geologic formations is treated. Calculations on simplified artificial models are given and discussed. (T.R.H.)

15460 ORNL-2560

Oak Ridge National Lab., Tenn.

STATUS REPORT ON WASTE DISPOSAL IN NATURAL SALT FORMATIONS. F. L. Parker, L. Hemphill, and Julian Crowell. Sept. 2, 1958. 59p. Contract W-7405-eng-26. $1.75(OTS)

The major sources of radioactive wastes in the future will be from stationary power stations. The ways being considered for waste disposal in the order of feasibility are: storage in salt beds, salt domes, or abandoned salt mines; storage in ceramic material or slag formed from high-level wastes in sheds on the surface of arid areas or in dry mines; and disposal of liquid wastes in porous media such as sandstone at relatively great depths. A discussion of the location of salt deposits and the properties of salt is presented, and it is pointed out that a research program is in progress at ORNL to determine results of various conditions imposed on salt formations by the waste. The design of a field experiment is discussed including testing a laboratory model, selection of a field test site, and the cost of such experiments. (J.R.D.)

15461

ASPHALT LINING OF RADIOCHEMICAL WASTE STORAGE BASINS. APPLICATION OF ASPHALTIC MEMBRANES APPEARS PRACTICAL AS LINING OF EARTH STORAGE PITS FOR AQUEOUS RADIOCHEMICAL WASTE. Clyde D. Watson and George A. West (Oak Ridge National Lab., Tenn.) and Arnold J. Hoiberg (The Flintkote Co.). Ind. Eng. Chem. 50, No. 8, 87A-91A(1958) Aug.

Membrane asphalt seems to offer the best lining protection for storage basins to be used in long-term retention of neutralized partially decayed radiochemical wastes, and asphaltic plank material is only slightly less desirable. Irradiation of these materials causes embrittlement, and a maximum dose is discussed. Chemical attack of solutions containing HNO_3 is very severe at temperatures of 150 to 225°F, and use of membranes at these temperatures should be considered only for solutions which contain less than 1% strong oxidizing acids. Salt solutions or alkaline solutions can be confined at 200°F if the membrane softening point is 270°F; however, tests indicate poor resistance to alkalies. (J.R.D.)

ENGINEERING

15462 APEX-401

General Electric Co. Aircraft Nuclear Populsion Dept., Cincinnati.

STRESS RESULTANTS AND OUT-OF-PLANE DEFORMATIONS IN STIFF RINGS ATTACHED TO ELASTIC CYLINDERS AND SUBJECT TO CONCENTRATED LOADS. Bernard W. Shaffer and Eric E. Ungar. Aug. 1958. 52p. Contracts AF33(038)-21102 and AT(11-1)-171. $1.50(OTS).

Expressions are derived which give the internal loads and deformations of a relatively stiff ring which is mounted on an elastic cylinder. Three basic types of loads acting on the ring are considered: a concentrated

force acting in the direction parallel to the axis of the cylinder, a bending moment acting about a radial axis, and a bending moment acting about a tangential axis. The entire problem is first analyzed for the general case in which the centers of twist of the ring crossections do not coincide with the mid-surface of the cylinder, and then also developed for the special case where these do coincide. Functions are tabulated which permit relatively rapid evaluation of the internal loads and deformations of the ring for the general as well as special case. An illustrative example is presented which gives an indication of the effect of the lack of coincidence of the centers of twist of the ring and the cylinder mid-surface. (auth)

15463 CF-58-8-10
Oak Ridge National Lab., Tenn.
SALT-LUBRICATED HYDRODYNAMIC JOURNAL BEARING TESTS NOS. 1 AND 2. P. G. Smith. Aug. 7, 1958. 11p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

The results of the hydrodynamic journal type bearing phase of the salt-lubricated bearing development program at Oak Ridge National Laboratory are given. One test each of two hydrodynamic journal type bearings constructed of INOR-8 versus INOR-8 was performed with molten salt #130 (62 LiF, 37BeF, 1 UF_4 mole %) at 1200°F as the lubricant. The first bearing operated for twenty minutes and the test was terminated due to seizure of the bearing and journal. The second bearing operated for 500 hours during which fifty-seven stop-start tests were performed and hydrodynamic lubrication was attained for extended periods at 1200 rpm and 200 lb radial load. Termination of the test was as scheduled at the completion of 500 hours of operation. Plans are also included for further testing. (auth)

15464 NACA-TN-4316
Lewis Flight Propulsion Lab., Cleveland.
FRICTION AND WEAR WITH REACTIVE GASES AT TEMPERATURES UP TO 1200°F. Gordon P. Allen, Donald H. Buckley, and Robert L. Johnson. Sept. 1958. 27p.

CF_2Cl_2, CF_3Cl, and SF_6 gases were used to lubricate hardened M-1 tool steel and other materials. A hemisphere rider ($^3/_{16}$-in. rad.) under a 1200-g load slid on a rotating disk at 120 ft/min. CF_2Cl_2 was effective up to 1200°F and CF_3Cl, while not as good a lubricant, gave less corrosion. Small amounts of SF_6 added to CF_2Cl_2 improved lubrication. SF_6 alone reduced wear but not friction of tool steel sliding against tool steel. Of the iron, copper, and nickel alloys studied, silicon-nickel alloys gave the best results. With silicon nickel, SF_6 gave both low wear and low friction at 600°F. For steel, corrosion was important with all gases. (auth)

15465 NCRE/R-211; NCRE/R-243; NCRE/R-244 and NCRE/R-372
Gt. Brit. Naval Construction Research Establishment, Dunfermline, Fife., Scotland.
THE BUCKLING UNDER EXTERNAL PRESSURE OF CIRCULAR CYLINDRICAL SHELLS WITH EQUALLY SPACED CIRCULAR RING FRAMES. PARTS I–IV. S. Kendrick. (Pt. I, Feb. 1953. 27p.; Pt. II, Sept. 1953. 34p.; Pt. III, Sept. 1953. 21p. and Pt. IV, July 1957. 28p.)

These four parts issued separately, but cataloged as a unit may be further identified as ACSIL/ADM/53/89 (UNDEX-300); ASCIL/ADM/53/89A (UNDEX-311); ACSIL/ADM/53/89B (UNDEX-312); and ACSIL/ADM/53/89C (UNDEX-376), respectively.

A method is presented for the evaluation of buckling pressures for cylinders reinforced with light frames equally spaced between deep frames. (auth)

15466 SC-3839(TR)
New Mexico. Univ., Albuquerque.
FACTORS INFLUENCING DIAL OPERATIONS. II. SPECIAL-PURPOSE DOUBLE-NUMBER DIALS. Roger J. Weldon, Ryoko Yafuso, and George M. Peterson. Apr. 13, 1956. 47p. For Sandia Corp. Contract [AT(29-1)-789]. $6.30(ph OTS); $3.00(mf OTS).

Results are described from tests on three special-purpose, double-number dials. The relative merits of the three dials were determined by the number of errors made in setting and checking them and also by the time required to perform these operations. (C.H.)

15467 UCRL-5298
California. Univ., Livermore. Radiation Lab.
NATURAL STEAM AND GEOTHERMAL POWER GENERATION. G. R. Maynard. July 25, 1958. 8p. Contract [W-7405-eng-48]. $1.80(ph OTS); $1.80(mf OTS).

A bibliography of natural steam and geothermal power generation is presented including a condensed summary of the information in each reference. Information is included concerning creation of thermo-artesian power sources. A section includes locations and characteristics of hot springs and geysers. (J.R.D.)

15468 CF-56-12-37
STATIC CALCULATION OF BOILER BOTTOMS. (Statische Berechnung von Kesselböden.) Maria Esslinger. Translated for Oak Ridge National Lab. Published by Springer-Verlag, Berlin, 1952. 129p.

Translation of p.1-39 originally issued as AEC-tr-2676; p.39-100 originally issued as AEC-tr-2850.

A method of calculation is given which permits the dimensioning of rotation bodies of complicated shapes with the same accuracy as experiment, but with considerable less effort. The method of calculation is schematized extensively so that difficult theoretical assumptions are eliminated in practice. It is fundamentally possible to calculate each arbitrary rotation-symmetrical boiler bottom with a curve meridian by means of the derived individual equations. However, this method has been completely developed and demonstrated by numerical examples only for normal boiler bottoms which consist of a spherical dome with an angular aperture $2\phi \leq 60°$ and a flange with a constant meridian radius. The bottom can be singly or doubly domed. In addition, the stresses at the point of aperture with and without flanged edge and in the range of the riveted seam between bottom and casing are calculated. (L.T.W.)

15469
PREDICTION OF CREEP IN BENDING FROM TENSION- AND COMPRESSION-CREEP DATA WHEN CREEP COEFFICIENTS ARE UNEQUAL. W. N. Findley (Brown Univ., Providence); J. J. Poczatek (Cook Research Labs., Chicago); and P. N. Mathur (Ford Motor Co., Dearborn, Mich.). Trans. Am. Soc. Mech. Engrs. 80, 1294-8(1958) Aug.

The method of predicting creep in bending from data on creep in tension previously described was extended to the prediction of creep in bending when the creep in tension and compression are unequal, and when the time-dependent and time-independent stress functions are unequal. It was shown that the stress distribution and position of the neutral axis in a beam charged with time when the creep in tension and compression were unequal; and the stress distribution changed with time when the time-dependent and time-independent stress functions were unequal. Computed creep deflections were compared with available data on canvas laminate and polystyrene, with good results for the former and fair results for the latter. (auth)

15470

GAS TURBINE MATERIALS. A SURVEY OF HIGH-TEMPERATURE MATERIALS AND THEIR APPLICATION TO THE GAS TURBINE. G. Lucas and J. F. Pollock. New York, The MacMillan Company, 1958. 170p. $5.75.

A survey of gas turbine materials is presented, which is intended to fill in the gap between metallurgical text books and those works concerned with the design and performance of gas turbines. The thermodynamic design of the gas turbine and the influence of fuels on the choice of materials are considered, along with a consideration of stress-temperature environment emphasizing creep. Special non-metallic and metal/non-metal combinations are discussed, and manufacturing methods are reviewed. (J.R.D.)

Heat Transfer and Fluid Flow

15471 CF-58-6-71

Oak Ridge National Lab., Tenn.

HRP-EVALUATION OF HEAT REMOVAL METHODS FOR CONTROLLING TEMPERATURES OF AN ORR SLURRY BOMB. J. M. Holmes. June 16, 1958. 23p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

Two methods were evaluated for removal of 1 to 5 kilowatts from a 1-in.- diam. by 10 in. long bomb to be maintained at 250 to 300°C. Conductance control, varying the composition of a helium–air mixture in a 8 mil annulus to give a controlled conduction heat transfer resistance, gave a simple, smooth, flexible control method. Use of water sprayed into air gave the required range of heat fluxes, but sometimes gave uncontrollable instabilities due to progressive vapor binding. (auth)

15472 GAT-T-547

Goodyear Atomic Corp., Portsmouth, Ohio.

PROCEDURE FOR MEASURING FREON 114 LEAK RATES IN CASCADE COOLANT CONDENSERS BY THE GAS DILUTION METHOD. D. L. Scott. Aug. 28, 1958. 10p. Contract AT(33-2)-1. $1.80(ph OTS); $1.80(mf OTS).

The gas dilution method for the measurement of Freon leak rates to the water side of cascade coolant condensers has been tested on various condensers in the X-333 building and on one condenser in the X-330 building. The gas dilution method involves injecting Freon 115 ($CClF_2-CF_3$) into the water inlet of a condenser suspected of leaking Freon 114 (mixture of $CClF_2-CClF_2$ and CCl_2F-CF_3). It is assumed that the two gases mix uniformly in the condenser before a gas sample is withdrawn from the three-way vent line valve. Knowing the rate of Freon 115 injection, and measuring the ratio of Freon 114 to Freon 115 in the outlet gas sample by an infrared method to be described, the Freon 114 leak rate can be calculated accurately. (auth)

15473 NP-6922

Convair Scientific Research Lab., San Diego, Calif.

AN EXPERIMENTAL INVESTIGATION OF THE TURBULENT BOUNDARY LAYER IN SUPERSONIC FLOW AROUND UNYAWED CONES WITH SMALL HEAT TRANSFER AND CORRELATIONS WITH TWO DIMENSIONAL DATA. Research Report No. 1. Walter S. Bradfield. Mar. 15, 1958. 149p.

Experimental work in the turbulent boundary layer in essentially adiabatic flow at supersonic speeds may be loosely divided into five main categories. They are as follows: experiments on flat plates; on cones; two-dimensional flows with pressure gradients; three-dimensional flows with pressure gradients; and flows with surface temperature gradients. The present work concerns itself with the second of these categories, namely, cone flow. The essence of the present work is the comparison by suitable engineering relations of cone flow experiments under constant surface temperature and nearly adiabatic flow with corresponding plate flow experiments, both compressible ($1 < M_1 < 5$), and incompressible. In the pursuit of this end, a new type of total temperature boundary layer probe was designed, developed, and applied to the first measurements of total temperature profiles in the boundary layer of a cone at supersonic speeds; a qualitative, integrated, physical picture of probe-boundary layer interactions was developed; correlations among velocity profiles, total temperature profiles, momentum thickness, displacement thickness, shape parameter and enthalpy increment for plate, cone, and axial flow cylinder were established; and local values of heat transfer and skin friction coefficients were compared with compressible and incompressible flow plate values. The result is that the engineer, knowing an incompressible relation for skin friction, a reference temperature defined by Eckert, the modified Reynolds analogy of Colburn, and the plate-to-cone transformation of the present work can readily predict skin friction and heat transfer values in a turbulent boundary layer on a conical body in flight at zero yaw. (auth)

15474 NP-6929

Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.

THE TRANSIENT TEMPERATURE DISTRIBUTION IN SEMI-INFINITE SOLIDS WITH MELTING. Final Technical Report [for] September 1955 to September 1958. J. E. Sunderland and R. J. Grosh. 108p. DA Project No. 5B99-01-004. Contract DA-33-008-ORD-1219.

A detailed analysis was made of the transient and steady-state temperature distribution in a melting semi-infinite solid. The solid, initially at a uniform temperature, was heated by an environment at a temperature above the melting point. The coefficient of heat transfer was considered to be constant. After heating started, the surface temperature increased until it reached the melting point, at which time melting began. Two cases were considered as the body melted: one in which the melt was removed as it formed, and the other in which it was retained. (auth)

15475

AN EXPERIMENTAL CONTRIBUTION TO THE TRANSITION FROM LAMINAR TO TURBULENT FLOW IN A PIPE. Julius Rotta. IX^e Congr. intern. Mécan. Appl. 3, 350-9(1957).

Experiments were made with air and with water, with the flow at Reynolds numbers slightly higher than the critical value, to determine whether turbulent flow will still intermittently occur if the fluctuations in the rate of discharge were prevented by some means. An expression for the critical Reynolds number for pipe flow, below which turbulent pipe flow will not occur, was derived on the basis of the experiments. (J.S.R.)

15476

TRANSITION FROM LAMINAR TO TURBULENT FLOW DURING UNSTEADY FLOW IN A SMOOTH PIPE. M. R. Carstens (Georgia Inst. of Tech., Atlanta). IX^e Congr. intern. Mécan. Appl. 3, 370-8(1957).

A study of flow establishment in a pipe was performed with a smooth straight circular pipe which was horizontally aligned. It was concluded that in the transition

from laminar to turbulent flow in a pipe the effects of free-stream turbulence can be avoided entirely with a temporally expanding boundary layer. The transition occurs in spots. The magnitudes of the laminar boundary layer Reynolds number at turbulence inception was in reasonable agreement with the theoretical values determined for Blasius flow over a flat plate. The downstream movement of a turbulent zone into a laminar zone is that of physical transport. The regions of laminar and turbulent flow in a pipe can be defined from the piezometric-head lines. With a systematic variation of boundary-layer parameters, the presence or absence of boundary-layer transition at the pipe junctions was found to be in qualitative agreement with the laminar boundary-layer stability theory. (J.S.R.)

15477

HEAT EXTRACTION IN POWER REACTORS. 3. G. Boxer (Birmingham Coll. of Tech., Eng.). Nuclear Power 3. 363-7(1958) Aug.

The effects of axial heat conduction on the axial distribution of temperature in the fuel elements, sheathing, and coolant are examined. (W.D.M.)

15478

APPLICATION OF THE ANALOG COMPUTER TO PRODUCT DYNAMIC PERFORMANCE IN TYPICAL HYDRAULIC CIRCUITS. Gerhard Reethof (Vickers Inc., Detroit). Trans. Am. Soc. Mech. Engrs. 80, 1299-1307(1958) Aug.

The successful use of electronic-analog-computing techniques in the simulation of typical hydraulic systems is demonstrated. As an example, the instabilities of a certain open-center hydraulic-booster system are simulated, and corrective action is indicated and verified. The study involves the analysis of a grossly nonlinear system and methods of function generation are given. (auth)

Materials Testing

15479 APEX-399

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

STRESSES IN RINGS DEFORMED OUT OF THEIR PLANES. Bernard W. Shaffer and Eric E. Ungar. July 3, 1958. 44p. Contracts AF33(038)-21102 and AT(11-1)-171. $1.25(OTS).

Equations are presented by means of which one may compute the shear stresses induced by internal twisting moments and transverse shear forces in circular rings whose cross sections are solid rectangles, thin-walled rectangles, or thin-walled channels. Although these equations are derived from straight-bar theory, it is shown that they introduce little error when applied to rings having cross sections whose radial dimensions are small compared to the ring mean diameters. Expressions are also derived for the locations of the centers of twist for rings having the afore mentioned cross sections. An analysis of normal stresses induced by internal bending moments is also presented. It is shown that straight-beam theory leads to considerable error, so that a more exact theory, which is described, should be applied for normal stress calculations. (auth)

15480 APEX-400

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

SOME SIMPLIFIED SOLUTIONS FOR RELATIVELY STIFF BEAMS ON ELASTIC FOUNDATIONS. Bernard W. Shaffer. Aug. 1958. 16p. Contracts AF33(038)-21102 and AT(11-1)-171. $0.50(OTS).

Maximum bending moments, rotations, and deflections of beams resting on elastic foundations and subject to central forces and bending moments are computed on the basis of a linear approximation to the foundation reaction. This reaction is determined from the rigid-body motion of the beam, and is thus statically determinate. The results of these approximate analyses are compared with those obtained from the exact theory in terms of the "characteristic parameter" of the beam, which is a function of the relative stiffnesses of the beam and the foundation. It is shown that the approximate analysis introduces very little error if the beam is stiff as compared to the foundation on which it rests. (auth)

15481 HW-50610(Suppl.A)

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

AUTOMATION OF A COBALT^{60} RADIOGRAPHY SYSTEM FOR CORED REACTOR FUEL ELEMENT QUALITY INSPECTION. Charles Ellis Huck. July 1, 1958. 26p. Contract [W-31-109-Eng-52]. $4.80(ph OTS); $2.70(mf OTS).

Cored type nuclear reactor fuel elements must be free of internal braze metal leakage in order to minimize the possibility of fuel element ruptures and consequent reactor shutdowns. A non-destructive test system is described herein which automatically feeds a fuel element to the test position, inspects it for possible leakage, "decides" whether the fuel element is a good one or a reject, and routes it to the proper outlet conveyor based on this "decision." Collimated gamma radiation from a Co^{60} source is directed axially through the fuel element core to a NaI (Tl) phosphor crystal–photomultiplier tube combination. The resulting signal pulses are amplified then counted by a preset scaler. Increased gamma energy absorption in a defective fuel element is indicated by a scaler count below the preset limit which causes it to be rejected. Increased inspection throughput and considerable cost savings have been realized by use of the automatic cobalt tester. (auth)

15482 SCTM-276-58(16)

Sandia Corp., Albuquerque, N. Mex.

AN INVESTIGATION OF LOW-VOLTAGE PERCUSSION WELDED CONNECTIONS BETWEEN STRANDED WIRE AND ELECTRICAL TERMINALS. D. W. Grobecker and H. Romero. July 23, 1958. 24p. Contract AF(29-1)-789. $4.80(ph OTS); $2.70(mf OTS).

Percussion-welded electrical connections appear to offer advantages only in special environments, such as service at high temperature, where soldered or mechanical joints are impractical. Simulated electrical connections between stranded copper wire and terminals of copper, brass, mild steel, and stainless steel were made by mechanically impinging the wire on the terminal with the simultaneous discharge of low-voltage capacitors between the parts. Comparative strength and flexure tests were made of the welded connections, soldered joints, and mechanical joints. The welded connections had lower reliability, average strengths, and flexure resistance than other joints. Because of the low-voltage restrictions, uncontrollable variables materially affected weld characteristics. In addition, the rigidity of the welded joint and the section differences between the wire and terminal contributed to lower connection life under conditions of wire flexure. Welded-connection performance under flexure was considerably improved by the use of thin-gage, flexible terminals. (auth)

15483 WAL-TR-648/12
Watertown Arsenal Lab., Mass.
TESTING FOR NOTCH SENSITIVITY IN WELDED JOINTS. Carl E. Hartbower. Aug. 1958. 25p. DA Project No. 5B93-32-002.

For two decades or more welding metallurgists and engineers have explored the problem of evaluating the notch-bar impact properties of welded joints. Little difficulty has been encountered in the case of deposited weld metal, but in the case of heat-affected base metal the results have not been very rewarding. The main problem in testing weld heat-affected zone is the steep gradient of structures present. Various approaches to the over-all problem of weld-joint evaluation are reviewed, and a method of accomplishing this evaluation is described. (auth)

15484
GAMMA-DEFECTOSCOPY OF METALS. SYMPOSIUM. S. T. Nazarov, ed. Moscow, Academy of Sciences, USSR, 1955. 142p. (In Russian)

The symposium includes reports presented at the conference on gamma defectoscopy of metals by various scientific research organizations and industrial laboratories. The subjects discussed included the photographic and ionization methods used in gamma defectoscopy and information on various metals and defects in manufactured items used in gammagraphic studies with the radioactive isotopes cobalt-60, cesium-137, iridium-192, etc. (R.V.J.)

Pumps

15485 HW-51826
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
EVALUATION OF A 5-HORSEPOWER GEL SUBMERSIBLE MOTOR-PUMP. P. B. McCarthy and J. Dunn. Sept. 1, 1957. Decl. Jan. 16, 1958. 19p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

A submersible, hermetically sealed, 5 horsepower electric motor close-coupled to a regenerative turbine pump was fabricated and was operated successfully and satisfactorily at HAPO for over 13,500 hr. During this period the pump was installed as a submerged unit and also as an in-line pump. The test fluids used included water and several simulated process solutions. The pump proved to be durable for continuous operation at flow rates up to 18 gpm and against heads up to 220 ft, although a minimum discharge flow rate of ½ gpm is necessary to prevent overheating of the motor. The motor possessed wear resistance characteristics superior to those exhibited by commercially obtainable "canned" motor pumps. When operated as a submersible agitator (with a propeller replacing the pump head), the unit provided extremely violent agitation to the contents of a 500 gallon tank. However, excessive wear of the Graphitar bearings was found after 40 hr of service, making further development necessary before the equipment can be recommended for agitator use. (auth)

Radiography

15486
PRINCIPLES OF HIGH ENERGY RADIOGRAPHY. Stanley S. Stacey (ANSCO, Binghamton, N. Y.). J. Soc. Non-Destructive Testing 16, 339-44(1958) July-Aug.

The effects of energy upon scattered radiation, radiographic contrast, and image sharpness are discussed. Means for exercising control over radiographic quality include the choice of the proper radiation source, film type, and film density. A complete familiarity with these principles and the means of controlling quality should prove valuable to radiographers contemplating the use of high-energy sources and requiring the use of a wide range of kilovoltages. (J.E.D.)

Tracer Applications

15487
AN INDEX OF CAVITATION EROSION BY MEANS OF RADIOISOTOPES. S. L. Kerr and Kjell Rosenberg. Trans. Am. Soc. Mech. Engrs. 80, 1308-14(1958) Aug.

A paint containing arsenic-76 was used to coat turbine runners. The activity of the discharge water was then used as an indication of the severity of cavitation corrosion at various turbine speeds. (D.E.B.)

Vacuum Systems

15488
A HIGH VACUUM VALVE. L. Blanaru (Inst. of Atomic Physics, Bucharest). J. Sci. Instr. 35, 184-5(1958) May.

A high-vacuum valve is described which uses tin, first molten and then solidified, as tightening element. The body of the valve is a molybdenum glass tube. With this vacuum valve it was possible to maintain a Bayard-Alpert manometer at a pressure of 5×10^{-8} mm of mercury. During repeated tests of 50 hours duration each, no noticeable leakage against air at atmospheric pressure could be detected. (A.C.)

15489
IONIC VACUUM PUMPS. Lewis D. Hall (Varian Associates, Palo Alto, Calif.). Science 128, 279-85(1958) Aug. 8.

The design characteristics of a number of modern ionic vacuum pumps are described and illustrated schematically. Problems in the design of pumps for ultra-high vacuum systems are reviewed. The development of pumps which transfer particles of gas to the solid state instead of removing them is discussed. (C.H.)

Waste Disposal

15490 NP-6925
Australia. Commonwealth X-Ray and Radium Lab., Melbourne.
RADIOACTIVE CONTAMINATION, DECONTAMINATION AND WASTE DISPOSAL: WATER SUPPLIES; LIQUID WASTES. Library Information Bulletin No. 40. July 1958. 7p.

Ninety-four selected references are included. (D.E.B.)

15491 ORNL-2508
Oak Ridge National Lab., Tenn.
AN EVALUATION OF ASPHALT AND OTHER MATERIALS FOR LINING RADIOCHEMICAL WASTE STORAGE BASINS. Arnold J. Hoiberg, Clyde D. Watson, and George A. West. Sept. 10, 1958. 50p. Contract W-7405-eng-26. $1.50(OTS).

Asphaltic membranes appear practical for lining earth storage pits for aqueous radiochemical waste provided that the wastes are neutralized and are decayed sufficiently that the self-heating temperature does not exceed 150°F and the time for the asphalt to acquire a dose of 10^9 r is more than 25 years. In laboratory

tests gamma irradiation of asphalts caused: evolution of H_2 and CO_2, resulting in 14 to 30% volume increase and a honeycomb structure; increase in softening point, slight increase in ductility, and decrease in penetration; decrease in flash point but no increase in "loss on heating"; increase in asphaltenes and resins and decrease in oils. The addition of mineral fillers was not beneficial. Prefabricated asphaltic membrane and plank samples were still serviceable after 10^9 r irradiation. Irradiated tars showed some change in ductility but little change in other physical properties. In 1- to 4-week immersion tests, asphalts deteriorated in simulated acid waste solutions above 150°C, but changes were slight when the HNO_3 concentration was <1%. Chemical damage to tars appeared to be similar to that of asphalts but the physical changes were not actually measured. In 1-year field tests an asphaltic membrane remained impervious to passage of neutralized waste containing 10^{-3} curie/liter, and a prefabricated asphalt plank sagged 1.5 in. but did not rupture while supporting 2 ft of gravel. In survey studies, soil solidified with liquid silicate conditioners was stable in acid waste but not in water or caustic waste. It was calculated that wastes from fuels irradiated to 10,000, 3,300, and 1,000 Mwd/ton and decayed 6 years would irradiate an asphalt lining to 10^9 r in 20, 79, and 300 years, respectively; with 10 years' decay the times would be 27, 95, and 365 years. Longer decay times offer little, if any, advantage. An open pit of 10^6 gal capacity could be constructed for $0.03 per gallon, and one with a concrete roof for $0.07 per gallon; corresponding costs for a 5×10^6 gal pit would be $0.02 and $0.05 per gallon. (auth)

MINERALOGY, METALLURGY, AND CERAMICS

Ceramics and Refractories

15492 NAA-SR-2542

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

MEASUREMENT ON THE CRYSTALLOGRAPHIC THERMAL EXPANSION OF ALPHA-ALUMINA AND BERYLLIA TO ELEVATED TEMPERATURES EMPHASIZING ANISOTROPIC EFFECTS. David J. Klein. Aug. 1, 1958. 24p. Contract AT-11-1-GEN-8. $0.75 (OTS).

A furnace which had been developed for x-ray-diffraction work was applied to the measurement of crystallographic thermal expansion of ceramic materials. It was necessary to develop a procedure to make best use of the limited amount of data obtainable at high temperatures on anisotropic materials. Data on the crystal expansion of MgO, Al_2O_3, and BeO with temperature are presented and compared with published data. Within rather small limits of error, the ratios c/a in Al_2O_3 and BeO are constant between 20 and 1750°C, indicating isotropic thermal expansion for these hexagonal lattices. Attempts to show effects of anisotropic crystallographic thermal expansion on the shapes of diffraction line profiles gave negative results. (auth)

15493 NP-6921

Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.

INVESTIGATION OF HIGH TEMPERATURE RESISTANT MATERIALS. Quarterly Report No. 12 [for] May 1, 1958 to July 31, 1958. C. R. Mason and J. D. Walton. 36p. Project No. A-212. Contract NOrd-15701.

The DTA curves obtained from pellets composed of beryllium and beryllia and heated in air showed two gradual exothermic rises, the maximum of which was 0.63 mv. The DTA curves obtained from beryllium thermite pellets all showed a rapid exothermic rise having a much higher peak than that obtained with beryllium alone. All of the data indicate that beryllium will rapidly reduce tungsten oxide, nickel monoxide, titania, zirconia, alumina, and chromic oxide to the elemental metals at temperatures in the neighborhood of 2000°F. In addition, the hard, sintered structure obtained in beryllium thermite pellets containing beryllia as the throttling material, indicates that enough heat is liberated by some of these reactions to form a dense, cermet type body without additional sintering above the required ignition temperature. Heat flux measurements taken in the nozzle section of the small oxyhydrogen rocket motor were high enough to confirm the severity of the nozzle test which has previously been observed through the rapid failure of most of the materials which have been tested. In addition to providing a severe screening test for nozzle inserts, the heat flux measurements taken in the exhaust of the motor indicate that specimens could be placed in this area for screening as possible nose cone materials. The tests conducted on silica–graphite nozzles showed that the particle size distribution of the silica in these nozzles is very critical. Evidently the proper distribution of silica must be present to provide a strong skeleton after sintering. The strength of these silica–graphite nozzles must be obtained from the silica and care must be taken to prevent interference with the sintering of the silica particles by the graphite addition. (auth)

15494

SUBSIEVE PARTICLE SIZE MEASUREMENTS ON PORCELAIN MATERIALS. R. H. Lester (General Electric Co., Baltimore). Am. Ceram. Soc. Bull. 37, 129-34 (1958) Mar.

A method was developed for the measurement of subsieve particle sizes utilizing the principle of gravitational and centrifugal sedimentation. Typical particle size distribution curves are shown for ball clays and china clays. (auth)

15495

SOME PARAMETERS AFFECTING CERAMIC-TO-METAL SEAL STRENGTH OF A HIGH-ALUMINA BODY. Sanford S. Cole, Jr. and Frank J. Hynes, Jr. (Raytheon Mfg. Co., Waltham, Mass.). Am. Ceram. Soc. Bull. 37, 135-8(1958) Mar.

Various fired properties are investigated for a 94.5% alumina body. Modulus of rupture, apparent specific gravity, apparent porosity, grain growth, impact resistance, loss factor, and ceramic-to-metal seal strength are measured as firing temperature is changed. Modulus of rupture, apparent specific gravity, apparent porosity, loss factor, and ceramic-to-metal seal strength are measured as flux content is changed. (auth)

15496

FORMATION OF CONTINUOUS SERIES OF SOLID SOLUTIONS IN SYSTEMS FORMED WITH CARBIDES, NITRIDES, BORIDES, AND SILICIDES OF TRANSITION GROUP METALS. R. B. Kotel'nikov (Kalinin Inst. of Non-Ferrous Metals and Gold). Zhur. Neorg. Khim. 3, 841-6(1958) Apr. (In Russian)

The existence of continuous series of solid solutions

in TiB_2–CrB_2 and the limited intersolubility of ZrB_2–CrB_2 were confirmed. (R.V.J.)

15497

PROPERTIES OF NIOBIUM–SILICON ALLOYS. G. V. Samsonov, V. S. Neshpor, and V. A. Ermakova (Inst. of Metal Ceramics and Special Alloys, Academy of Sciences, Ukrainian SSR). Zhur. Neorg. Khim. 3, 868-78(1958) Apr. (In Russian)

Metallographic and x-ray diffraction investigations of niobium–silicon systems with 0 to 100 at.% Si showed the existence of three intermediate complexes: the Nb_4Si with hexagonal lattice with constants a = 3.59 and c = 4.46 A; the Nb_5Si_2 in three modifications α and β (a = 6.56, c = 11.86 A, and a = 10.00, c = 5.07 A, respectively) and hexagonal γ modification with constants a = 7.52 and c = 5.24 A; and the hexagonal silicides $NbSi_2$ with lattice constants a = 4.78 and c = 6.56 A. The melting points and the electric conductivity of the alloys were determined, and hypothetical phase diagrams were plotted on the basis of the data. The corrosion resistance was tested at 1000°C in the air; the systems did not exhibit strong corrosion resistance. (R.V.J.)

15498

PROPERTIES OF BORIDE SYSTEMS WITH TRANSITION GROUP HIGH-MELTING-POINT METALS. G. A. Meerson, G. V. Samsonov, et al. (Kalinin Moscow Inst. of Non-Ferrous Metals and Gold). Zhur. Neorg. Khim. 3, 898-903(1958) Apr. (In Russian)

Phase compositions, structure of diffusion interaction products, microstructure, and heat resistance of TiB_2–CrB_2, TiB_2–W_2B_5, and ZrB_2–CrB_2 systems were studied. Constitution diagrams for each system are presented, and tables of the initial boride powders and the data obtained on properties of chromium, titanium, tungsten, and zirconium borides are included. (R.V.J.)

15499

STRUCTURE AND PROPERTIES OF COPPER–GRAPHITE MIXTURES. P. S. Livshits. Zhur. Priklad. Khim. 31, 394-402(1958) Mar. (In Russian)

The structure of the copper–graphite mixtures is described, and quantitative evaluation is made of the effects of changes in the composition on the properties of the mixture. (R.V.J.)

Corrosion

15500 HW-43085

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

CORROSION OF ALUMINUM IN TAP WATER. C. Groot and V. H. Troutner. June 6, 1956. 8p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

A study of the aluminum corrosion mechanism was undertaken in which aluminum samples were exposed to flowing 300 Area tap water at 90°C. Aluminum samples exposed to tap water at 90°C and removed at regular intervals for measurement of sample weight loss, film weight, and film composition showed a rapid initial corrosion rate which decreased to practically zero within the first few weeks of exposure. Analyses of the corrosion products remaining on the samples showed that only 10% of the corroded metal could be found in the corrosion product film; the rest must have washed away. It may be that this washing away indirectly controls the rate, through control of the film thickness. (auth)

15501 NDA-84-9

Nuclear Development Corp. of America, White Plains, N. Y.

EFFECTS OF SODIUM AND WATER LEAKS ON EXPERIMENTAL SDR BARRIERS. C. Bolta and J. O'Neill. Aug. 15, 1958. 45p. Contract AT(30-3)-256. $7.80 (ph OTS); $3.30(mf OTS).

Tests are described which are part of the experimental program on means of maintaining separation of sodium coolant and heavy water moderator in the SDR. A test section was built to simulate a portion of a fuel coolant tube with its encasing barrier tube assembly and calandria tube. Leaks of sodium and moderator from their containment were simulated by means of sodium and water jets directed against the barrier tube assembly. Double and single-walled barrier assemblies were tested. (auth)

15502 NP-6913

Cobalt Information Center, Columbus, Ohio.

CORROSION BIBLIOGRAPHY ON COBALT AND COBALT ALLOYS. [1957]. 11p.

Approximately 150 references are cited from periodical and report literature. (T.R.H.)

15503 USBM-U-40

Bureau of Mines. Northwest Electrodevelopment Experiment Station, Albany, Oreg.

THE EFFECT OF ALUMINUM ON THE CORROSION RESISTANCE OF ZIRCALOY 2. R. L. Carpenter, M. D. Carver, and E. T. Hayes. July 5, 1955. Changed from OFFICIAL USE ONLY Nov. 9, 1956. 8p. $1.80 (ph OTS); $1.80(mf OTS).

An investigation was undertaken to determine the aluminum tolerance of Zircaloy-2, the alloy of zirconium presently used in applications requiring resistance to corrosion in high-temperature water. Alloys of Zircaloy-2 containing different amounts of aluminum from 100 to 380 ppm were prepared and tested in high-temperature water and steam for resistance to corrosion. It was found that with aluminum content as low as 100 ppm corrosion resistance is not equal to that of specification grade Zircaloy-2 whose maximum aluminum content is 50 ppm. It was also found that corrosion resistance decreases with increasing aluminum content over the range of 100 to 380 ppm aluminum. (auth)

15504 USBM-U-52

Bureau of Mines. Northwest Electrodevelopment Experiment Station, Albany, Oreg.

THE EFFECT OF 0.5 PERCENT OXYGEN ON THE CORROSION RESISTANCE OF ZIRCALOY 2. M. D. Carver and E. T. Hayes. Oct. 5, 1955. Changed from OFFICIAL USE ONLY Nov. 9, 1956. 13p. $3.30(ph OTS); $2.40(mf OTS).

A fifteen-pound ingot of Zircaloy-2 with an oxygen content of about 0.5% was made by double arc-melting of compressed electrodes into which were incorporated the alloying additions. From a section of the ingot corrosion specimens were prepared, initially in two conditions: (1) cold worked 15% after hot working at 850°C and (2) annealed at 850°C after hot rolling at 850°C. The cold rolled specimens were tested both etched and unetched. The annealed specimens were separated into five groups. One group was tested in the annealed condition and each of the remaining groups was subjected to one of the following procedures: (1) heat treated in vacuum at 1000°C, 1 hr, water quench; (2) heat treated in vacuum at 1000°C, 1 hr, furnace cool; (3) hydrogen treated, 750°C, 1 hr, furnace cool; (4) hydrogen treated, 750°C, 24 hr, furnace cool. Samples were corrosion tested in triplicate in both water and steam according to standard practice established by the Zirconium Corrosion Committee. It was found that 0.5% oxygen has a definite lowering effect on the corrosion resistance of Zircaloy-2. Further it was found that

the corrosion resistance with 0.5% oxygen was improved by hydrogen treatment and that the intensity or time of hydrogen treatment affected the extent of improvement. Specific effects of various heat treatments, cold work and etching were not conclusively shown. (auth)

15505 USBM-U-122

Bureau of Mines. Northwest Electrodevelopment Experiment Station, Albany, Oreg.

THE ALUMINUM LIMIT OF ZIRCALOY 2. M. D. Carver and E. T. Hayes. June 1, 1956. Changed from OFFICIAL USE ONLY Nov. 9, 1956. 18p. $3.30(ph OTS); $2.40(mf OTS).

The variation in corrosion resistance of Zircaloy-2 with aluminum content in the range of 50 to 175 ppm aluminum is shown. Selected blends of zirconium sponge representing this range of aluminum content were processed to wrought Zircaloy-2 which was subjected to analysis and corrosion testing in hot water and steam. Weight gain data were correlated with aluminum content. It was found that in this aluminum range the corrosion rate increases gradually with increasing aluminum content, there being no well defined aluminum limit beyond which the corrosion rate increases sharply. The total change in corrosion rate over this range of aluminum content was found to be small with practically all specimens tested having stable corrosion rates for 308 days in water at 680°F and for 123 days in steam at 750°F and 1500 psi. (auth)

15506

THE INFLUENCE OF NICKEL ON THE ELECTROCHEMICAL AND CORROSION BEHAVIOUR OF STEEL. G. M. Florianovich, J. M. Kolotyrkin, and N. K. Smirnova. Doklady Akad. Nauk S.S.S.R. 120, 845-8 (1958) June 1. (In Russian)

Potentiometric statistical studies were made of the effect of chemical composition on the electrochemical and corrosion behavior of steel in the state of passivation. (R.V.J.)

15507

PROTECTIVE POTENTIALS OF METALS. V. V. Gerasimov (Academy of Sciences USSR). Izvest. Akad. Nauk S.S.S.R. Otdel. Khim. Nauk No. 3, 263-9(1957). (Translated from Referat. Zhur. Khim. No. 1, 1958. Abstract No. 1588.)

An analysis is made of the method available for calculating the protective potential of metals, and the nonvalidity of these methods is shown. A method of calculating the protective potential is proposed, which is based on the assumption of the existence of an exponential correlation between the rate of corrosion of the metal and its potential (on the condition that ionization of the metal constitutes the controlling stage of the process. The formula used is $\varphi_z = \varphi_{st} - 0.1 \lg i_{a_{st}}$, where φ_z is the value of the protective potential, φ_{st} is the steady potential of the metal, and $i_{a_{st}}$ is the corrosion rate at φ_{st}, expressed in units of current intensity. The corrosion rate of the metal at φ_z is selected on the basis of the permissible corrosion losses of the protected structure. On the basis of the experimentally determined values of $i_{a_{st}}$ and φ_{st}, the protective potentials were calculated for Cu, Zn, Cd, Mg, Pb, Fe, and cast iron in 1.5% solution of NaCl, and Fe in synthetic lake water. The agreement between experimental and calculated data was found to be satisfactory. The conditions under which this method can not be used are described. (J.S.R.)

15508

INFLUENCE OF NICKEL ON INTERGRANULAR CORROSION OF 18% CHROMIUM STEELS. J. R. Upp (Wright-Patterson Air Force Base, Ohio) and F. H. Beck and M. G. Fontana (Ohio State Univ., Columbus). Trans. Am. Soc. Metals 50, 759-72(1958).

Type 304 (18-8) stainless steel is made susceptible to intergranular corrosion when heated in the temperature range of approximately 1200 to 1400°F. This heat treatment imparts resistance to intergranular corrosion for Type 430 (18% Cr) steels. Quenching from 1900 to 2000°F provides optimum resistance to Type 304 but makes Type 430 susceptible to intergranular corrosion. The major compositional difference in these steels is nickel (8% and 0%). Alloys containing intermediate nickel compositions were cast, rolled, heat treated, and tested to determine the influence of this element on corrosion behavior. It was found that the transition occurs at about 2.5 to 3% nickel. Steels with higher nickel should be heat treated like the austenitic steels and those below like the ferritic steels. An unexpected result was the good resistance to intergranular corrosion of all of these alloys when water quenched from 1400°F. (auth)

15509

THE SOLUBILITY RATE OF THE OXIDE FILM ON ALUMINUM. N. P. Fedot'ev and I. Kosha-Shomodi. Zhur. Priklad. Khim. 31, 497-500(1958) Mar. (In Russian)

The variables affecting the solubility rate of aluminum oxide films in electrolytes were investigated. (D.E.B.)

15510

BIBLIOGRAPHIC SURVEY OF CORROSION, 1954-1955. Publication No. 58-1. A Compilation of Corrosion Abstracts. A. Irene Humphrey, comp. Houston, Texas. National Association of Corrosion Engineers. 1958. 474p.

The abstracts have been arranged in accordance with the NACE Corrosion Abstract Filing Index. Cross references have been included to take care of those abstracts which might be placed under another heading than the one chosen. Author and subject indexes have been added to facilitate searching for specific information. (W.L.H.)

Geology and Mineralogy

15511 NYO-2290

Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy.

THE ADAPTATION OF NEW RESEARCH TECHNIQUES TO MINERAL ENGINEERING PROBLEMS. Progress Report. July 31, 1958. 23p. Contract AT(30-1)-956. (MITS-40).

Research on adsorption of organic and inorganic ions on quartz continued with studies of adsorption of amines, chloride, sodium, and inorganic ions in the presence of amine salt. The solubility of quartz in salt solutions at 90°C and pH 10 and in pure water was measured. Progress is also reported in the investigation of Ag_2S flotation using potassium ethyl xanthate. (See also NYO-7708.) (T.R.H.)

15512 RMO-2681

Nevada. Univ., Reno. Mackay School of Mines.

WET ATTRITIONING OF ORES FROM THE COLORADO PLATEAU. Henry P. Ehrlinger, III. Sept. 1956. 23p. Contract AT(49-1)-624. (UN-TR-6). $4.80(ph OTS); $2.70(mf OTS).

The effects of time and several reagent combinations on the attritioning of uranium-bearing ores was studied with emphasis on the carnotite-in-sandstone type. Tests were also made on subsequent thickening, filtering, and leaching of the high-grade slimes produced. (T.R.H.)

15513 TEM-563A
Geological Survey, Washington, D. C.
RECONNAISSANCE FOR RADIOACTIVITY IN THE GOLD HILL MINING AREA, BOULDER COUNTY, COLORADO. [Part I]. R. H. Campbell. Feb. 1955. 28p., 1 illus. $0.25(OTS).

Several radioactive deposits were found as a result of reconnaissance in the Gold Hill mining area, Boulder Co., Colo. The ore deposits of the area have been worked chiefly for gold. All ore shipped has come from fissure veins, most of which are gold telluride veins. There are some important sulfide veins which show a vague zonal distribution of pyritic gold ores and silver-lead ores. The results of this reconnaissance suggest a possible relationship of the radioactive deposits to this indistinct sulfide zoning; however, the zoning is so obscure that its practical application to prospecting for uranium is of doubtful value at the present time. Pitchblende, torbernite, metatorbernite, and schroeckingerite have been identified in specimens from the area; however, no uranium minerals have yet been identified from most of the radioactive deposits, and the uraniferous material present is probably in disseminated small particles. Although selected samples from several localities assay 0.10% uranium or more, the known deposits are small and probably are not of immediate economic importance. (auth)

15514
EFFECTS OF OXYGEN AND NITROGEN ON THE SELECTIVE FLOTATION OF TITANIUM AND ZIRCONIUM MINERALS AND THE IMPORTANCE OF THEIR CRYSTALLINE STRUCTURE. V. V. Bakakin, I. N. Plaksin, and E. M. Chaplygina. Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk No. 6, 84-90(1958) June. (In Russian)

Selective flotation of titanium and zirconium with preliminary treatment of the pulp with oxygen and nitrogen gases and studies of the crystal structure are described. (R.V.J.

15515
STUDY ON RADIOACTIVE SPRINGS. Kyozo Kikkawa (Kyoto Univ.). Japan J. Geophys. 1, 1-25(1954) May.

From the continuous measurements of a radioactive spring in Arima, Hyōgo Prefecture, fairly general conditions can be gained which are not contradictory to the general results having been found on other radioactive springs. Rainfalls affect the spring water to increase its Rn content, while the dilution by ground water in and after the rain decreases it. These total effects cause the fluctuations of Rn content which seem to be irregular according to the rainfalls. The increases of Rn content originate not only from wet but also from cold ground conditions. As both these conditions reduce the exhaling velocity of radon gas from ground surface, it is supposed that the variations in exit velocity of radon from the spring water in the course of flow under the ground are some of the most important causes to change in Rn content. The results obtained by many investigators can be explained quantitatively after analyzing the assumed simple pattern of radioactive springs. Even if the condition of the ground surface is not changed, it is probable that changes of discharged velocity of the spring water vary its Rn content. Seasonal and daily variations can be explained by such processes. (auth)

15516
GROUND-WATER STUDIES IN NEW MEXICO USING TRITIUM AS A TRACER. Haro von Buttlar and Immo Wendt (New Mexico Inst. of Mining and Tech., Socorro). Trans. Am. Geophys. Union 39, 660-8(1958) Aug.

A new method for ground-water investigations is described which employs tritium as a tracer. Tritium is produced in the atmosphere by cosmic radiation and hydrogen-bomb explosions, the latter causing large peaks in the tritium concentration of rain water. These peaks show up subsequently in underground water. Thus, an 'apparent' age of ground-water samples can be determined, enabling inference as to hydrological quantities such as the rate of flow of aquifers and the size of recharge reservoirs. To demonstrate the feasibility of the method, measurements were made on ground-water samples from New Mexico. Since the tritium content of the samples was extremely low, the tritium was enriched by electrolysis, and its concentration determined by the use of the low-level counting technique. (auth)

15517
K–A AND Rb–Sr METHODS AND AGE OF PRECAMBRIAN OF USSR. A. A. Polkanov and E. K. Gerling (Lab. of Precambrian Geology, Academy of Sciences of the USSR, Leningrad). Trans. Am. Geophys. Union 39, 713-15(1958) Aug.

The procedure of mica age determination by the K–Ar method is described. The age data obtained by the K–Ar and Rb–Sr methods for Precambrian of the USSR together with their estimation are given. The data obtained are compared with the stratigraphy. (auth)

15518
SELECTED ANNOTATED BIBLIOGRAPHY OF THE GEOLOGY OF URANIFEROUS AND RADIOACTIVE NATIVE BITUMINOUS SUBSTANCES, EXCLUSIVE OF COALS IN THE UNITED STATES. Harriet Nell Jones. U. S. Geol. Survey Bull. 1059-D, 1958. 29p. and 1 illus.

This bibliography of 49 annotated references lists reports of work that appeared before June 30, 1956. The annotations, arranged alphabetically by author, emphasize the geologic and mineralogic aspects of uraniferous and radioactive bituminous substances, exclusive of coals, in the United States. Indexes to the annotations are provided according to author, geographic area, stratigraphic unit, and subject. (auth)

15519
MIGRATION MECHANISM OF RADIUM AND THORIUM ISOTOPES. V. I. Baranov, A. M. Babeshkin, K. B. Zaborenko and S. V. Pirozhkov (Lomonosov Moscow State Univ.). Zhur. Neorg. Khim. 3, 1054-9(1958) Apr.

It is shown that the behavior of thorium isotopes is not determined by the crystalline shape of the initial compounds but by the chemical properties of thorium. This should be considered in evaluations of thorium migration in rock. (R.V.J.)

15520
PRELIMINARY GEOLOGIC MAP OF THE VERDURE 1 SW QUADRANGLE, SAN JUAN COUNTY, UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 164. Frank G. Lesure, Lyman C. Huff, and Fredrick Stugard, Jr. Washington, U. S. Geological Survey, 1958. $0.50.

15521
PRELIMINARY GEOLOGIC MAP OF THE VERDURE 3 NE QUADRANGLE, SAN JUAN COUNTY, UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 165. Frank G. Lesure, Lyman C. Huff, and Fredrick Stugard, Jr. Washington, U. S. Geological Survey, 1958. $0.50.

Metals and Metallurgy

Refer also to abstracts 16050, 16051, 16053, 16054, and 16055.

15522 AECU-3802
Detroit Edison Co., Detroit.
EXAMINATION AND HEAT TREATMENT OF THREE

ZIRCONIUM-CLAD URANIUM-10 WT PER CENT MOLYBDENUM FUEL PINS FOR APDA, INC. Engineering Laboratory and Research Department Report 57E21-2. J. J. Bodzin. Jan. 2, 1958. 47p. $7.80 (ph OTS); $3.30(mf OTS).

Three fuel pins were submitted for metallurgical examination and heat treatment. The purpose of this examination was to determine the quality of the fuel pins as received and after heat treatment. The three pins examined were more uniform in cladding thickness than those previously examined. The uranium alloy was apparently more homogeneous, and no swirls were seen. The zirconium cladding was not as clean as that observed on other pins, nor was the ductility as great. The bond between core and cladding was not as effective as that seen on other fuel pins. (auth)

15523 ANL-5442

Argonne National Lab., Lemont, Ill.

CASTING URANIUM-5 w/o ZIRCONIUM-1.5 w/o NIOBIUM ALLOYS INTO ZIRCONIUM AND ZIRCALOY-2 CONTAINERS. J. W. Frank and R. E. Macherey. July 1958. 49p. Contract W-31-109-eng-38. $1.50 (OTS).

A series of experimental castings have been made with the object of exploring the proposition that uranium and high uranium alloys could be bonded to zirconium and zirconium alloys by a direct casting method. Unalloyed uranium and uranium alloyed with 5 wt. % Zr and 1.5 wt. % Nb have been cast into zirconium and Zircaloy-2 molds of various shapes and sizes. Castings made in cans of circular cross section were well bonded and sound, provided the molds were outgassed at elevated temperature before use and proper preheating precautions were observed. Molds of rectangular cross sections, however, did not yield as satisfactory results, mainly because of porosity. The asymmetry of this type of mold probably contributed to the lack of success. Good bonds were obtained between uranium and zirconium by casting into graphite molds lined on opposite sides with zirconium plates. (auth)

15524 ARF-2068-5

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

THE SYSTEM ZIRCONIUM–IRON–TIN. Summary Report No. 5 [for] July 1, 1957—June 30, 1958. Lee E. Tanner. July 29, 1958. 61p. Project No. B 068. Contract AT(11-1)-315. $9.30(ph OTS); $3.60(mf OTS).

The zirconium–iron–tin system was investigated up to the first compound in each binary system ($ZrFe_2$ and Zr_4Sn) between the temperatures 500 and 1100°C. A careful study of the solubility of iron and tin in alpha-zirconium was also made between the temperatures 200 and 800°C. The alloys were prepared from "Grade 1" iodide zirconium (as received and electron bombardment melted) and high purity iron and tin by nonconsumable-electrode arc melting techniques under an inert atmosphere. Ingots were homogenized, cold worked when possible, cut or broken into small specimens, and given equilibration anneals at the prescribed temperatures. Metallographic examination of the heat treated and quenched samples was the main method of investigation. X-ray diffraction and magnetic susceptibility techniques were also employed. The results of this program are summarized in 12 partial isothermal sections. The important features of the system indicate that there is little solubility for tin in the compound $ZrFe_2$. The single-phase field is believed to exist in the vicinity of 55 wt. % Fe. The compound theta appears to be a continuous phase originating at the binary compound (Zr_4Sn) and dissolving up to about 7.5 wt. % Fe while maintaining a constant tin composition of the order of 24.5 wt. %. A four-phase ternary eutectic ($L \rightleftharpoons \beta + \theta + ZrFe_2$) occurs between 930 and 935°C. It is likely that a four-phase ternary peritectoid ($\beta + \theta \rightleftharpoons \alpha + ZrFe_2$) occurs at a temperature just above the binary zirconium-iron eutectoid (which takes place between 790 and 800°C). A four-phase ternary eutectoid ($\beta \rightleftharpoons \alpha + \theta + ZrFe_2$) taking place just above the zirconium–iron eutectoid remains an alternate possibility. The solubility limit of alpha-zirconium was found to be extremely low in the presence of iron, falling below the most dilute binary iron and ternary alloys prepared at temperatures of 600°C and lower. (auth)

15525 HW-42184(Rev.)

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

THE METALLOGRAPHY OF IRRADIATED URANIUM–PREPARATION, CATHODIC VACUUM ETCHING, AND REPLICATION. T. K. Bierlein, J. R. Morgan, and G. R. Mallet. May 25, 1956. 33p. Contract W-31-109-Eng-52. $6.30(ph OTS); $3.00(mf OTS).

Facilities and procedures used in the preparation and metallographic examination of specimens made intensely radioactive by neutron irradiation in atomic reactors are described. The applicability of remote cathodic vacuum etching and remote replication to optical and electron metallography in the study of neutron irradiation damage in uranium is demonstrated. (auth)

15526 KAPL-M-JMC-1

Missouri School of Mines [and Metallurgy], Rolla.

POWDER METALLURGY. STAINLESS STEEL–BORON CARBIDE AND ZIRCONIUM–BORON–CARBIDE COMPACTS. Progress Report. Paul G. Herold and Theodore J. Planje—Janed M. Cisar, ed. May 1955. 28p. For Knolls Atomic Power Lab. Contract W-31-109-Eng-52, Subcontract K-259. $4.80(ph OTS); $2.70 (mf OTS).

Powder metallurgical compacts were prepared consisting of varying boron carbide-to-base metal ratios, the base metals in these investigations being types 347 and 302 stainless steels and zirconium. Systematic studies of the effects of sintering and reheat temperatures on the physical properties of compacts are described and the resultant data presented in tabular form. Thermal differential analyses were performed to determine compounding temperatures of B_4C with the matrix materials studied. (auth)

15527 MAB-48-SM

National Research Council. Materials Advisory Board.

EVALUATION OF HIGH STRENGTH STEELS FOR ELEVATED TEMPERATURE APPLICATIONS IN AIRCRAFT. PART II. PRODUCTS OTHER THAN FLAT ROLLED. Edmund V. Bennett. Aug. 15, 1958. 36p. Contract DA-36-039-sc-76436.

This report supplements MAB-131-M.

The availability of steel bars, extrusions, forgings, castings, and tubes to aircraft manufacture are discussed. Trends in usage and demand are outlined, and data on compositions, properties, and forms of various steels are given. (T.R.H.)

15528 NACA-TN-4371

California Inst. of Tech., Pasadena.

SOME OBSERVATIONS RELATING TO RECOVERY OF INTERNAL FRICTION DURING FATIGUE OF ALUMINUM. S. R. Valluri. Sept. 1958. 30p.

Recovery of internal friction during periods of rest in specimens subjected to fatigue stresses in torsion was studied experimentally with high-purity aluminum. The

effective heat of activation for the process is found to be about 10,000 cal per gram molecule or less. The dislocations responsible for the recovery of internal friction may be the same as those responsible for fine slip which, according to one existing theory, is the mechanism responsible for fatigue failure. Experimental results indicate that obtaining a recovery factor independent of stressing history may possibly be associated with installing a cyclic process in which the subgrain structure is well established. (auth)

15529 NAVORD-5190
Naval Gun Factory, Washington, D. C.
INVESTIGATION OF MECHANICAL PROPERTIES, CORROSION RESISTANCE, AND OXIDATION RESISTANCE, OF THERMENOL, AN IRON–ALUMINUM–MOLYBDENUM ALLOY. K. L. Kojola. Oct. 17, 1955. 32p. (NGF-T-42-56).

Thermenol is an alloy of approximately 82% iron, 15% aluminum, and 3% molybdenum. An investigation revealed it to be extremely brittle at room temperature. Its ductility and hardness are unaffected by annealing. Its optimum mechanical properties are those in the temperature range of 1100 to 1200°F. Its corrosion resistance (salt spray) is superior to that of 16-Alfenol and AISI 410 corrosion-resistant steel but inferior to that of AISI 304 corrosion-resistant steel. It is superior to AISI 304 or 410 corrosion-resistant steels as to resistance to oxidation at elevated temperature (scaling). Due to its tendency to work harden it is quite difficult to machine. However, maching can be satisfactorily accomplished by using high-speed steel tools, slow speeds, low feeds, and an ample flow of coolant. (auth)

15530 NMI-1174
Nuclear Metals, Inc., Cambridge, Mass.
DUCTILITY IN BERYLLIUM RELATED TO GRAIN ORIENTATION AND GRAIN SIZE. Jacob Greenspan. Aug. 9, 1957. 39p. Contract AT(30-1)-1565. $1.25 (OTS).

The anisotropy of fracture and slip, i.e., the brittleness and ductility of the beryllium single crystal, is characteristic also of polycrystalline beryllium in which the grains are oriented in a preferred manner. Beryllium with grain orientations resulting from hot working either uni-directionally or bi-directionally is ductile or brittle in directions given by the anisotropy and orientation of the grains. Textures developed from various hot-working sequences are given, and tensile results are correlated with textures. Not only texture but fine grain size is necessary for obtaining high tensile elongation. Ultimate tensile strength and elongation are both correlated with grain diameter. Of particular interest is the case in which unusually high tensile elongations of 30 to 40% are obtained when basal planes are oriented to carry little or no tensile stress. (auth)

15531 NMI-1183
Nuclear Metals, Inc., Cambridge, Mass.
NIOBIUM–URANIUM ALLOYS AS CONTAINER MATERIAL FOR MOLTEN URANIUM EUTECTIC ALLOYS. G. W. Powell. Aug. 22, 1957. 20p. Contract AT(30-1)-1565. $0.75(OTS).

A previous investigation concerned with liquid-core fuel elements and the materials from which they could be constructed revealed that an alloy of U–5 wt. % Nb had considerable promise as container material. Results are given from a further investigation of this alloy, as well as another containing 10 wt. % Nb, to determine the time and temperature limits within which the oxide layer remains protective, the factors which hasten or delay the breakdown of the film, and the mechanism whereby the film deteriorates. (auth)

15532 NMI-1194
Nuclear Metals, Inc., Cambridge, Mass.
THE COLD WORKING OF EXTRUDED ZIRCALOY TUBING. N. R. Gardner and P. Loewenstein. Apr. 30, 1958. 55p. Contract AT(30-1)-1565.

The extrusion of high-quality, small diameter Zircaloy tubing used for fuel elements was studied. Experimental data are given on: copper gradients for Zircaloy-2 tubing, etching, lubrication and annealing, drawing, and product evaluation. (T.R.H.)

15533 NP-5897(Suppl.)
Climax Molybdenum Co. of Michigan, Detroit.
ARC-CAST MOLYBDENUM BASE ALLOYS. Supplement to Summary Report. M. Semchyshen and R. Q. Barr. 1957. 181p. Project No. NR-039-002. Contract N8onr-78700.

Studies of the mechanical properties of wrought Mo-base alloys were extended to include Mo–Hf binaries, a promising Mo–Ti–Zr ternary, and one Mo–Ti–Zr–Hf quaternary. The studies included micrography, high-temperature hardness, recrystallization, grain coarsening tendencies, tensile tests, brittle to ductile transition, and creep-rupture tests. Investigation of the mechanism of strengthening in the Mo–Ti system continued. The alloy systems Mo–Ti, Mo–Nb, Mo–Zr, and Mo–Hf were studied as to their preparation, structure, hardness, oxidation rates, forgeability, and recrystallization. The metallography and x-ray fluorescence techniques used are described. (T.R.H.)

15534 NP-6871
Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.
COMPILATION OF AVAILABLE INFORMATION ON THE Ti–7Al–(3-4)Mo ALLOY. R. W. Douglass and F. C. Holden. July 18, 1958. 105p.

The technical information available to the Titanium Metallurgical Laboratory on the Ti–7Al–(3-4)Mo alloy as of March, 1958, is summarized. The Ti–7Al–(3-4) Mo is a relatively newly developed bar and forging alloy designed for use in elevated-temperature applications and as high-strength forgings. At present the alloy is being produced by The Titanium Division, Crucible Steel Company (formerly Rem-Cru Titanium, Incorporated), and has been produced in experimental quantities by Armour Research Foundation and Harvey Machine Company. The Crucible alloy, C-135AMo, is nominally Ti–7Al–4Mo and the others are Ti–7Al–3Mo. In general the data presented have been reproduced from the original source; however, in many cases it was considered desirable to compile or condense data, depending upon its abundance. Insofar as possible, recommended practices in production and fabrication are included, and the information presented may be considered as typical of current practice. For those areas where a diversity of opinion exists as to the best procedure, an effort has been made to include the different points of view. (auth)

15535 NP-6914
Cobalt Information Center, Columbus, Ohio.
ALUMINUM–COBALT ALLOYS. [1957]. 4p.

A bibliography consisting of 62 references to periodical, report, and patent literature is presented. (T.R.H.)

15536 NP-6915
Cobalt Information Center, Columbus, Ohio.
BIBLIOGRAPHY ON ELECTROPLATING OF COBALT AND COBALT ALLOYS. Feb. 1, 1957. 16p.

15537 NP-6916
Cobalt Information Center, Columbus, Ohio.
U. S. GOVERNMENT AGENCY SPONSORED RESEARCH ON COBALT ALLOYS. F. R. Morral. Apr. 15, 1958. 26p.

A bibliography of reports of United States government-sponsored research programs on cobalt alloys is presented. The references are given by name of agencies doing the research arranged alphabetically. A subject listing and a price and availability index are included. 151 references. (T.R.H.)

15538 NP-6917
Cobalt Information Center, Columbus, Ohio.
COBALT IN HIGH-TEMPERATURE ALLOYS. Special Report No. 1. F. R. Morral. Jan. 31, 1958. 12p.

Impressions obtained on visits with some 32 organizations which use cobalt, produce cobalt, or do research on cobalt alloys are summarized. The visits were made to exchange information on cobalt availability and discuss the use of cobalt and future trends in consumption of cobalt. (T.R.H.)

15539 NP-6918
Cobalt Information Center, Columbus, Ohio.
MACHINING OF COBALT SUPERALLOYS. Special Report No. 2. C. T. Olofson and F. R. Morral. Mar. 31, 1958. 13p.

Work-hardening tendencies of cobalt superalloys resemble those of austenitic stainless steels. Therefore, many of the machining techniques used for these steels are also applicable for superalloys. Heavy duty, vibration-free machine tools should be used for best results. Cutting tools must have smooth tool-chip contact areas, and sharp cutting edges free of feather edges. Tools must be strong, and rigidly mounted with a minimum of overhang. Slower speeds and feeds than those used for stainless steel should be used for minimum cutting temperatures. The depth of cut should be sufficient to prevent burnishing or glazing, and second cuts should be avoided if possible. Soluble oil emulsions and chemically active oils are normally used as cutting fluids. Carbon dioxide, impinging on the cutting site, has been successful for certain machining operations on superalloys. (auth)

15540 NP-6928
Ohio State Univ. Research Foundation, Columbus.
DEVELOPMENT OF AN OXIDATION RESISTANT COLUMBIUM ALLOY. Status Report No. 17. for the Period: April 16, 1958–August 15, 1958. Rudolph Speiser. Aug. 18, 1958. 24p. RF Project No. 467. Contract N6onr-225(28) (NR039 005).

A preliminary screening of Nb–Ti–Zr alloys indicated a 50 at. % Zr–45 at. % Nb–5 at. % Ti alloy to possess the best combination of low oxidation rate and nonporous adherent oxide film. Further tests of this alloy at 900°C, 1000°C, and 1100°C showed a rapid initial weight gain which drops after 3 hours. Simultaneous internal and external oxidation occurs resulting in a pearlitic dispersion of oxide phases in a solid solution matrix. The composition, structure, and hardness of the oxidized alloy were determined. (T.R.H.)

15541 NYO-8115
Franklin Inst. Labs. for Research and Development, Philadelphia.
TECHNICAL PROGRESS REPORT. July 1958. 8p. Contract AT(30-1)-1484. $1.80(ph OTS); $1.80(mf OTS).

This technical progress report is divided into two portions. The first portion discusses the research in surface diffusion; the second, the work on diffusion in the defect alloy system Sn–In. (auth)

15542 NYO-8665
Hausner (Henry H.), New York.
THE FORMING OF COMPLICATED SHAPES BY POWDER METALLURGY SLIP CASTING. Henry H. Hausner. Aug. 15, 1958. 15p. Contract AT(30-1)-2131. $3.30(ph OTS); $2.40(mf OTS).

The effects of pressure gradients and the resulting density gradients during conventional powder metallurgy pressure compacting are discussed. Steps in the metal powder slip casting process are reviewed, and applications of the process for the fabrication of porous materials and parts, and also for hollow parts of various shapes are shown. The experimental results of slip casting stainless steel tensile test bars, with two different mold designs, of solid and hollow turbine compressor blades, are described. The test results obtained, heretofore, are with respect to stainless steel tensile bars characterized by a density of 98.6%, a tensile strength of 77,500 psi, and an elongation of 56.6%. (auth)

15543 TID-5153(Del.)
Sylvania Electric Products Inc. Atomic Energy Div., Bayside, N. Y. and New York Operations Office, AEC.
SYMPOSIUM ON THE PREPARATION AND CHARACTERISTICS OF METAL POWDERS, JANUARY 29-30, 1953, HELD AT NEW YORK AND BAYSIDE, N. Y. Dec. 1953. Decl. with deletions Mar. 15, 1957. 194p.

Thirty-six papers are presented: Design of Feed Materials Plant, Fernald, Ohio; Thermodynamic Feasibility of Various Reactions and PVT Relations in the U–H system: Fundamental Considerations; General Approaches to the Production of U; Equipment and Process for Production of Uranium Hydride; Preparation of Metal Hydrides; Atomization Process for U Powders; Preparation of Th Powder; Preparation of ThH_4 from ThO_2; Preparation of ThH_4; Preparation of Th and Zr by Electrolysis of Fused Salts; Preparation of Zr Powder by the Knoll Process: Hydride Method; Preparation of Zr by Thermal Decomposition of CaH_2; Fused-Salt Production of Zr; Preparation of Zr by Vapor Deposition and Glow Discharge; Present and Projected Methods of Preparing Be Powder; Preparation of Be Directly from Its Compounds; Procedures for Determination of Particle Size and Distribution in Sub-Sieve Range; Particle Size and Distribution; Classification of Metal Powders by Screening, Fractional Sedimentation, and Air Classification; Screening and Roller Analysis; Safe Handling of Powders; Minimum Exposure of Personnel to Powder; Chemical Analysis of Powders; Mechanism of Pressing Powders; Low-Temperature Pressing-Sintering Techniques; Hydrostatic Pressing Technique; Mechanical Working of Metal Powders; Extrusion of Be; Rolling of Metal Powders; General Principles of Sintering as Applied to Nuclear Reactor Materials; Hot-Pressing of Be, Th, and Be alloys; and Sintering or Heat Treatment of U Compounds or Alloys. (T.R.H.)

15544 WADC-TR-57-468
Denver. Univ. Denver Research Inst.
THERMAL PROPERTIES OF HIGH TEMPERATURE MATERIALS. [Period covered]: July 1, 1956 through July 31, 1957. Richard D. Seibel and George L. Mason. Oct. 15, 1957. 64p. Project title: DSPS MATERIALS. Task title: GE-ANP MATERIALS. Contract AF33(616)-3696. (AD-155605).

Equipment has been designed and built for the measurement of the specific heat, thermal conductivity and thermal expansion of a series of ten metals and ceram-

ics. These measurements are from about 1000°F to the melting point or 3000°F, whichever is lower. A vacuum dilatometer using a linear variable differential transformer as the sensing element has been used. A comparative method for measuring thermal conductivity has been used. The heat capacity was determined with an ice calorimeter and its associated high temperature furnace designed to operate up to 5000°F. Data are presented for the expansion of all of the test materials. Enthalpy, specific heat and thermal conductivity data were determined for only part of the materials. All data are presented graphically. (auth)

15545 WADC-TR-58-246
Southwest Research Inst., San Antonio.
DETERMINATION OF MATERIALS DESIGN CRITERIA FOR 6Al-4V TITANIUM ALLOY AT ROOM AND ELEVATED TEMPERATURES. [Period covered] January 1956 to May 1958. J. K. Childs and M. M. Lemcoe. May 1958. 376p. Project Nos. 7351 and 7360. Contract AF33(616)-3348.

In order to establish design criteria on the 6Al-4V titanium alloy, tensile, compressive, bearing, and shear properties have been determined on both bar and sheet material at temperatures from 75 to 1000°F. In addition, tensile properties of sheet material were determined after 100-hour exposure at 600, 800, and 1000°F. Test results were compared with recently established minimum requirements for tensile strength in order to derive design values for compression, bearing, and shear. Other properties investigated include minimum bend radius for 105° bend and notched tensile strength at temperatures from 75 to 1000°F, and torsional properties at room temperature. Axial load fatigue characteristics were investigated at temperatures from 75 to 1000°F for both smooth and notched specimens at stress ratios of 0 (stress-rupture), 0.3, 1.0, and infinity. Descriptions of the test specimens, equipment, and procedures used are included. Test results are reported in tables and in curves showing the effect of temperature on the various mechanical properties. (auth)

15546 WAL-TR-401/301
Watertown Arsenal Lab., Mass.
FEASIBILITY OF TITANIUM FOR WELDED MISSILES. Carl E. Hartbower and George M. Orner. Aug. 1958. 25p.

A study was made of the feasibility of welded titanium sheet for missile applications. Evaluation was based primarily on short-time elevated-temperature tensile properties and a notch-tensile-impact test for notch sensitivity. Three alloy types were investigated; viz., Ti-4Al-2V complex (1Mo-1Cr-1Sn), Ti-6Al-4V, and Ti-5Al-2½Sn. With the exception of a few tests with unalloyed consumable electrode, welding was evaluated using the inert-gas-shielded tungsten-arc process with Ti-6Al-4V filler wire. Tensile properties were considered satisfactory with the exception of low ductility in the materials which had been converted from ingot to sheet on an experimental basis. Although all materials suffered loss of ductility after welding (with Ti-5Al-2½Sn least affected), 100% tensile joint efficiencies were realized. Notch sensitivity as indicated by notch-tensile-impact was indicated to be a problem, particularly after welding. Marked variations in notch sensitivity from heat-to-heat of a given composition type were noted. (auth)

15547 WAPD-CTA(GLA)-183(Rev. 2)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE DETERMINATION OF HYDROGEN AS AN IMPURITY IN ZIRCONIUM AND ZIRCALOY. P. Elbling, G. W. Goward, and R. K. McGeary. Feb. 6, 1958. 5p. $1.80(ph OTS); $1.80(mf OTS).

Hydrogen is extracted from the metal or alloy by induction heating at 1050°C in a molybdenum or graphite crucible in a vacuum. The gas is transferred from the furnace to a calibrated volume by means of a diffusion pump. Hydrogen present in the original sample is calculated from the increase in the calibrated volume as measured with a McLeod gage. (auth)

15548 WAPD-NCE-9040
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
QUARTERLY PROGRESS REPORT FOR THE TECHNOLOGY SECTION-SPECIAL MATERIALS SECTION FOR THE PERIOD APRIL 1 TO JUNE 30, 1958. J. G. Goodwin, J. D. Grozier, L. S. Rubenstein, and F. L. Shubert. July 15, 1958. 31p. $6.30(ph OTS); $3.00 (mf OTS).

The cause of blister-type corrosion defects in Zircaloy-2 strip was found to be the presence of inclusions which have been related to areas high in oxygen and/or nitrogen. The effects of various levels of impurity elements on the room-temperature tensile properties of Zircaloy-2 were determined statistically. The effect of hydrogen on the alpha-plus-beta phase region of Zircaloy-2 was determined. Hydrogen up to 1570 ppm was found to have no effect on the corrosion rate of Zircaloy-2. The effect of annealing in the alpha-plus-beta phase region on the room temperature tensile and corrosion properties of Zircaloy-2 were determined. The alpha-plus-beta phase field for vacuum-melted Zircaloy-2 was defined both on heating and cooling and as a function of heating and cooling rates. (W.L.H.)

15549 AEC-tr-3268
DEPENDENCE OF THE HEAT RESISTANCE OF ALUMINUM ALLOYS UPON THEIR COMPOSITION AND STRUCTURE. A. A. Bochvar. Translated by Michael Roman (Westinghouse Electric Corp. Bettis Atomic Power Div.) from Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk, 1369-84(1947). 31p.

A method for measuring heat resistance of Al alloys at high temperatures was sought. A hardness test was devised which would give rapid qualitative and quantitative results coinciding with results of the more time-consuming tensile tests. Thus the number of lengthy tensile tests is significantly reduced. The results of these hardness tests for eleven alloys (Al-Cu-Mg-Ni, Al-Cu-Mg, Al-Mg, and Al-Cu-Si-Zn, all containing traces of Fe, and some with traces of Mn) are given and discussed. (T.R.H.)

15550 NP-tr-127
DIFFUSION IN ALLOYS OF TITANIUM WITH NIOBIUM. N. V. Grum-Grzhimaylo (Groom-Grzhimaylo). Translated for U.K.A.E.A., Atomic Energy Research Establishment from Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk, No. 7, 24-8(1957). 12p.

The phenomena of diffusion and self-diffusion through a substance are determined by a series of processes which occur on the surface and also in the actual crystalline mass of a substance. Thus the constants of diffusion obtained as a result of measurement portray a phenomenon with varying significance. An attempt is made to show these various processes, according to their character and physical nature, which may have an important effect on the result of the definition of the diffusion constants. (A.C.)

15551
ZIRCONIUM FOR THE NUCLEAR INDUSTRY. Atomics and Nuclear Energy 9, 271-3(1958) Aug.

Quantity production of zirconium at a new American

plant and its use to protect reactor fuel elements against corrosion are described. (A.C.)

15552

AUTOMATIC REMOTE WELDING. N. T. Shvetskov and B. Kh. Voskan'yan. Avtomat. Svarka No. 5, (62), 62-71 (1958). (In Russian)

The method and machine described make possible automatic remote-controlled welding in inaccessible spots. The first uses will be in repair of weld joints on pipelines in closed trenches or in highly corrosive media. The machine has a pneumatic membrane defectoscope, a milling head, a welding head, and a blower for air or shielding gas mounted in one common housing which will be sunk into a trench to the pipe when the machine is installed on the manhole. The work of all mechanisms in the workhead housing can be watched by a mirror which is movable and can be turned into any position around a pipe. The design and operation of the equipment are described in detail, and technological recommendations are given. (TCO)

15553

ORIENTATION SUPERSTRUCTURE CAUSED BY THE MECHANICAL DEFORMATION OF AN Fe–Ni ALLOY. Robert Vergne. Compt. rend. 247, 197-200(1958) July 16. (In French)

The existence of an orientation superstructure created by mechanical deformation in an Fe–Ni alloy is shown. The effect of the pressure of treatment on the variation of the magnetization energy of the sample was studied. (tr-auth)

15554

THE EFFECT OF POLARIZATION ON THE MECHANICAL PROPERTIES OF STEEL. G. V. Karpenko and R. I. Kripyakevich (Inst. of Mechanization and Automation, Academy of Sciences, Ukrainian SSR). Doklady Akad. Nauk S.S.S.R. 120, 827-9(1958) June 1. (In Russian)

Effects of polarization on the mechanical properties of steel were tested in various electrolytes with anode and cathode polarization from external current sources. (R.V.J.)

15555

THE CONSTRUCTION OF CONADES IN TWO-PHASE REGIONS OF METAL SYSTEM EQUILIBRIUM DIAGRAMS BY THE MICROHARDNESS METHOD. V. N. Vigdorovich (Kalinin Moscow Inst. of Non-Ferrous Metals and Gold). Doklady Akad. Nauk S.S.S.R. 120, 1027-30(1958) June 11. (In Russian)

It is shown that measurements of microhardness can be used for plotting conades (Tie Line) of the α + Cu_3Ti region in the Al–Cu–Ti constitution diagram at 500 to 850°C. (R.V.J.)

15556

SOLID SOLUTIONS IN THE AlSb–GaSb SYSTEM. N. A. Goryunova and I. I. Burdian (Inst. of Physics and Tech., Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 120, 1031-4(1958) June 11. (In Russian)

The physico-chemical analysis confirmed the presence of solid solutions in the pseudo-binary AlSb–GaSb system. (R.V.J.)

15557

THE EFFECT OF SILICON ON THE SOLUBILITY OF OXYGEN IN IRON AND CHROMIUM MELTS. V. V. Averin and A. M. Samarin. Doklady Akad. Nauk S.S.S.R. 120, 1253-4(1958) June 21. (In Russian)

Results are given of experiments made in order to determine the effect of silicon (up to 1.5%) on the solubility of oxygen in iron and chromium melts at 1600°C. (R.V.J.)

15558

THE THERMODYNAMICS OF THE FORMATION OF THE HIGHER IRON ANTIMONIDE. V. A. Geiderich, J. I. Gerasimov, and A. A. Veecher (Lomonosov Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 120, 1274-6(1958) June 21. (In Russian)

The method of electromotive forces was used in thermodynamic studies of $FeSb_2$ formation from elements in the reaction: Fe + 2Sb = $FeSb_2$. Twelve alloys of seven various compositions within the heterogeneous area of $FeSb_2$ + Sb on the Fe + Sb phase diagram were studied. (R.V.J.)

15559

URANIUM MINERALIZATION IN ROCKS OF THE BERNHARD CRYSTALLINE LAYER. Th. Hugi, F. de Quervain, and G. Welti. Experientia 14, 234-5(1958). (In German)

Radioactive rocks were found in the layers of the Grande Dixence S.A. X-ray, chemical, and chalcographic analyses have shown the presence of uranium in the form of pitchblende. The mineralization is shown, in the sandstone and chloritic mica schists, by dark horizons. The pitchblende is associated with pyrite, chalcopyrite, galena, covellite, and hematite. At another location mineralization is not apparent. The radioactive rock is a carbonate sericitic quartz containing uranium. (tr-auth)

15560

EFFECTS OF HYDROGEN ON THE STRUCTURE AND PROPERTIES OF TITANIUM AND ITS ALLOYS. S. G. Glazunov, I. I. Kornilov, and A. M. Yakimova. Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk No. 6, 30-6(1958) June. (In Russian)

A review is presented of data published in Russia and abroad. (R.V.J.)

15561

APPLICATION OF THE ION BOMBARDMENT CLEANING METHOD TO TITANIUM, GERMANIUM, SILICON, AND NICKEL AS DETERMINED BY LOW-ENERGY ELECTRON DIFFRACTION. H. E. Farnsworth, R. E. Schlier, T. H. George, and R. M. Burger (Brown Univ., Providence). J. Appl. Phys. 29, 1150-61(1958) Aug.

The ion-bombardment cleaning method has been successfully applied to the (100) faces of germanium, silicon, and nickel, and to the (0001) face of titanium. Conditions and precautions necessary for the production of clean surfaces are described. Tests have been made for contamination from the ambient during the cleaning procedure for germanium. It has been shown that contamination approximating one-half monolayer does not occur under the conditions which were obtained, and that the method is capable of producing surfaces which are atomically clean. Results for clean (100), (111), and (110) germanium faces and the (100) silicon face indicate that the atomic positions in the surface planes are not the same as the corresponding positions in the bulk structure. For (100) nickel and (0001) titanium, the positions of the atoms in the surface planes are in agreement with x-ray data. In the case of titanium, an unidentified surface structure was present until after several cycles of alternate heating and ion bombardment. In the case of nickel, a double-spaced surface monolayer and in some cases a single-spaced, simple-square structure, attributed to carbon, was present until after several cycles of alternate heating and ion bombardment. (auth)

15562

ON THE COMPRESSIBILITIES OF SIMPLE METALS. W. G. McMillan and A. I. Latter (RAND Corp., Santa Monica, Calif.). J. Chem. Phys. 29, 15-17(1958) July.

An isothermal equation of state is derived from the Coulomb virial theorem for simple metals consisting of imperturbable (i.e., invariant) kernels embedded in a uniform sea of valence (e.g., s) electrons. Comparison with experiment at room temperature gives good agreement for the alkali and alkaline earth metals, but is understandably erratic for other groups. The compressibility is simply related to the heat of formation of the normal gaseous ion kernel. (auth)

15563

THE MICROTOPOGRAPHY OF OXIDE FILMS ON NIOBIUM. J. V. Cathcart, J. J. Campbell, and G. P. Smith (Oak Ridge National Lab., Tenn.). J. Electrochem. Soc. 105, 442-6(1958). Aug.

An electron microscopic study of the oxide films formed on niobium permits the apparently anomalous oxidation rate behavior of niobium to be explained in terms of the formation of small, blister-like cracks in the oxide film. An oxidation model, based on the idea that an oxidation process which is maintained by interstitial-anion or anion-vacancy diffusion leads to the generation of stresses in the oxide film, is proposed to account for these results. The observation of similar blister-like cracks in oxide films on tantalum is also reported. (auth)

15564

PREPARATION AND IDENTIFICATION OF THE THORIUM GERMANIDES. A. G. Tharp (Purdue Univ., Lafayette, Ind.) and Alan W. Searcy and Hans Nowotny (Univ. of California, Berkeley). J. Electrochem. Soc. 105, 473-6(1958) Aug.

X-ray diffraction studies indicate the existence of at least six thorium germanide phases. The phase of highest germanium content is $ThGe_{3.0\pm0.4}$, tentatively identified as cubic or pseudo cubic with $\alpha_0 = 11.72A$, α-$ThGe_2$, isostructural with α-$ThSi_2$ and α-USi_2, is tetragonal, space group D^{19}_{4h}-I4/amd, $\alpha_0 = 4.106 \pm 0.003A$, $c_0 = 14.193 \pm 0.005A$. A phase of composition $ThGe_{1.6\pm0.3}$ (β-$ThGe_2$) has a distorted AlB_2 structure. ThGe is cubic, space group O^5_h-Fm3m (NaCl Type), with $\alpha_0 = 6.033 \pm 0.001A$. Th_3Ge_2 is primitive tetragonal, space group D^5_{4h}-P4/mbm, with $\alpha_0 = 7.971 \pm 0.004A$ and $c_0 = 4.170 \pm 0.003A$. A phase of composition $ThGe_{0.3\pm0.1}$ gives a complex diffraction pattern. Reactivities with a few common chemical reagents are reported for α-$ThGe_2$, $ThGe_{1.6}$, and $ThGe_3$. (auth)

15565

THE USE OF NICKEL-ALUMINUM ALLOY COATINGS FOR THE PROTECTION OF MOLYBDENUM FROM OXIDATION. D. E. Couch, H. Shapiro, and A. Brenner (National Bureau of Standards, Washington). J. Electrochem. Soc. 105, 485-6(1958) Aug.

The protective coatings described were prepared by plating the Mo with 1 mil of Cr followed by 7 mils of Ni. The samples were then plated with 2 to 3 mils of Al. Several methods of forming Al-Ni alloy coatings were studied, and the most effective method of forming the Al-Ni layer was by electrodeposition from a fused cryolite bath at 1000°C. (L.T.W.)

15566

THE AGEING CHARACTERISTICS OF TERNARY ALUMINIUM-ZINC-MAGNESIUM ALLOYS. I. J. Polmear (Aeronautical Research Labs., Melbourne). J. Inst. Metals 86, 113-21(1957) Nov.

A systematic study was made of the aging characteristics of a wide range of ternary aluminum-zinc-magnesium alloys with basic zinc contents of 4, 6, and 8% zinc and magnesium contents within the range 0 to 3%. Hardness/aging-time curves were determined at regular temperature intervals between -20 and +240°C tests being carried out for periods of up to 2 years' duration. The most significant factor in the development of high strength properties in alloys based on the aluminum-zinc-magnesium system appears to be the pronounced effect that small quantities of magnesium have on the age-hardening capacity of aluminum-zinc alloys. This is thought to arise from the preferential interaction of zinc and magnesium atoms which might be expected from atomic-size considerations and from thermodynamic relationships. The experimental results show clear evidence of the existence of two stages in the aging processes of most of the ternary alloys. Identification of the phases was not possible, but it is concluded that they consist of G.P. zones and an intermediate precipitate. The temperature ranges of stability of the G.P. zones have been established and are shown to extend with increasing degree of supersaturation in respect of both the zinc and magnesium contents. These results will serve as a basis for further studies. (auth)

15567

ENTHALPY AND HEAT CAPACITY FROM 0° TO 900°C OF THREE NICKEL-CHROMIUM-IRON ALLOYS OF DIFFERENT CARBON CONTENTS. Thomas B. Douglas and Ann W. Harman. J. Research Natl. Bur. Standards 60, 563-8(1958) June.

The enthalpy relative to 0°C of three alloys was measured at nine temperatures from 100 to 900°C by a precise "drop" method. The alloys contained approximately 76% of nickel, 15% of chromium, and 8% of iron, with carbon contents of 0.02, 0.07, and 0.11%, respectively. The results are almost independent of the several variations in prior heat treatment investigated, and the heat-capacity-temperature curves of the three alloys are almost coincident, but there is a marked shift in each curve within the interval 500 to 600°C. (auth)

15568

A LESSON IN FABRICATING NUCLEAR PARTS. Metal Progr. 74, No. 2, 68-74(1958) Aug.

A discussion of the fabrication of reactor components from zirconium alloys and hafnium using metal working techniques developed for precision and to avoid contamination is presented. Welding is done in a dry box with an atmosphere of helium or argon, the forming is done hot, and a special sand blast-HNO_3-HF surface treatment is included to remove oxide films and pickle the surface. (J.R.D.)

15569

POWDER METALLURGY OF URANIUM AND THORIUM. Alan Blainey (Anglo-American Corp., Johannesburg, South Africa). Metal Progr. 74, No. 2, 79-84(1958) Aug.

A brief summary of recent British work on the powder metallurgy of uranium and thorium is presented. Uranium powder is produced directly from urania following production of a stable homogeneous oxide, attained by decomposing ammonium diuranate. The urania thus produced is reduced with calcium or magnesium, followed by compacting and sintering. Thorium powder is produced by reduction of thoria with calcium. Sintering and compacting and the resulting slugs are discussed. (J.R.D.)

15570

W-545, A BETTER TURBINE DISK ALLOY. J. T. Brown (Westinghouse Electric Corp., East Pittsburgh). Metal Progr. 74, No. 2, 87-90(1958) Aug.

A new iron-base turbine disk alloy having a good combination of high-temperature stress-rupture strength and ductility, and low-temperature tensile strength was developed. Boron in amounts from 0.005 to 0.15% increases the inherent ductility of the present austenitic precipitation hardening alloys. Further strengthening, by additions of larger amounts of titanium, is then possible without allowing the material to become notch sensitive. (auth)

15571

PRODUCTION OF DISCALOY BY VACUUM ARC MELTING. D. R. Carnahan (Westinghouse Electric Corp., Blairsville, Penna.). Metal Progr. 74, No. 2, 100-2(1958) Aug.

A description of the production of Discaloy by the consumable-arc process is presented. It is pointed out that the cleanliness of the electrode and starting material affect the ingot which is produced, and a procedure was established for the production of 12-in. diameter ingots having a progressively solidified structure, sound surface, and high ingot-to-product yield. (J.R.D.)

15572

A ROLLING MILL FOR PLUTONIUM. THE PROBLEMS OF ENCLOSED OPERATION. D. Mann (Albert Mann's Engineering Co., Ltd.) and R. J. Wakelin and B. J. Ward (A.W.R.E. Aldermaston). Nuclear Eng. 3, 339-43(1958) Aug.

Many interesting design features are incorporated in this description of modifications to a rolling mill to operate under glove-box conditions. (auth)

15573

SOVIET LITERATURE ON WELDING. V. A. Nevskiy. Svarochnoye Proizvodstvo No. 6, 46-7(1958).

Thirty new books are listed with short descriptions of each, plus a list of 12 articles contained in Soviet welding publications for 1957 and 1958. These 12 articles deal with welding, cutting, and soldering. (TCO)

15574

A PRECISE X-RAY INVESTIGATION OF ALLOYED GERMANIUM–INDIUM pn TRANSITION. Günther Mack (Universität Tübingen, Germany). Z. Physik 152, 26-33 (1958). (In German)

A precise x-ray investigation by the compensation method of Kossel and van Bergen is reported on the pn transition of alloyed Ge–In. In the alloying zone the Ge lattice in contrast to the base materials expands to $\Delta a/a_0 = 3 \times 10^{-5}$. An In concentration of $N_{In} \cdot 6 \times 10^{18}$ cm^{-3} was obtained, in agreement with the values which were known from the resistance measurements on In-saturated germanium. The n zone of the alloyed pn transition is free of lattice perturbation in the accuracy limits of this method as far as could be detected. The recrystallized part of the pn transition has the texture of the base crystal; the lattice, however, was noticeably disturbed up to the pn boundary. Slips appeared up to 13 angular minutes. The range of the accuracy with which the crystal region investigated could be located with respect to the pn boundary depends on the finite penetration depth of the x radiation and amounts to several microns. (tr-auth)

15575

CONSTITUTION DIAGRAM OF NIOBIUM–TUNGSTEN. V. S. Mikheev and D. M. Pevtsov (Baikov Inst. of Metallurgy, Academy of Sciences, USSR). Zhur. Neorg. Khim. 3, 861-6(1958) Apr. (In Russian)

Physico-chemical investigations were made of the constitution diagrams of niobium–tungsten alloys. It was found that solid solutions form during the crystallization process in alloys; in agreement with theoretical data. The hardness of annealed and quenched alloys changes alternately; the highest point of hardness is reached with 10 to 20% W, and the lowest (200 to 300 H_v) with 40 to 50% tungsten. (R.V.J.)

15576

PHASE DIAGRAMS OF TITANIUM–NIOBIUM–MOLYBDENUM ALLOYS. I. I. Kornilov and R. S. Polyakova (Baikov Inst. of Metallurgy, Academy of Sciences, USSR). Zhur. Neorg. Khim. 3, 879-88 (1958) Apr. (In Russian)

Chemical interactions of molybdenum–niobium–titanium components were studied, and the phase diagrams of quenching and annealed states at 1100°C were plotted. (R.V.J.)

15577

PHASE DIAGRAM OF CHROMIUM–TUNGSTEN–MOLYBDENUM SYSTEM. N. V. Grum-Grzhimailo and D. I. Prokof'ev (Baikov Inst. of Metallurgy, Academy of Sciences, USSR). Zhur. Neorg. Khim. 3, 889-95(1958) Apr. (In Russian)

Phase diagrams and isothermal properties of chromium–molybdenum–tungsten systems were studied at 1800, 1300, and 1000°C. Parameter measurements of high-temperature solid solutions were made for plotting the parameter surface and isoparameter lines of alloys at 1800°C, and for determining the limits of decomposition isotherms for ternary solid solutions at 1300 and 1000°C. The polythermal volume of the two-phase region in the ternary system was determined. (R.V.J.)

15578

PHASE DIAGRAM OF IRON–COBALT–SULFUR SYSTEM. N. G. Moleva, P. S. Kusakin, E. A. Vetrenko, and N. P. Diev. (Inst. of Metallurgy, Urals Branch of Academy of Sciences, USSR). Zhur. Neorg. Khim. 3, 904-10(1958) Apr. (In Russian)

A section of cobalt–iron–sulfur from quasi-binary FeS–Co_4S_3 was studied using thermal, dilatometric, specific gravity, microhardness, and microstructure methods. Three surfaces of primary crystallization were revealed. The solubility of cobalt sulfides in sulfur iron varies from 42.4% at the eutectic temperature to 24.5% at room temperature. The solubility of iron sulfide in cobalt sulfide does not change with temperature and equals 20% FeS. Phase diagrams of cobalt–iron–sulfur systems and isotherms of the system liquidus are plotted. (R.V.J.)

15579

SOME REGULARITIES IN APPEARANCE OF METASTABLE SYSTEMS OF Fe–C AND TRANSITION OF THESE SYSTEMS INTO STABLE STATE. I. V. Salli (Dnepropetrovsk State Univ.). Zhur. Neorg. Khim. 3, 924-33(1958) Apr. (In Russian)

Phase transitions on steel and cast iron surfaces, during thermal treatment in vacuum, the coalescence of dispersion carbides in steel, and metallographic structures of Fe–C alloys were studied. (R.V.J.)

15580

CONSTITUTION DIAGRAM OF THE CRYOLITIC ANGLE OF CRYSTALLIZATION POINT FOR Na_3AlF_6–Al_2O–MgF_2 AND Na_3AlF_6–AlF_3–MgF_2. E. Vatslavik and A. I. Belyaev. Zhur. Neorg. Khim. 3, 1044-7(1958) Apr. (In Russian)

Crystallization temperature, density, electric conductivity, marginal angles of wettability, and aluminum losses of $Na_3AlF_6-Al_2O_3-MgF_2$ and $Na_3AlF_6-AlF_3-MgF_2$ melts were studied. The presence of MgF_2 in the melts increases their density and wettability but reduces the crystallization temperature, electric conductivity, and the aluminum losses. (tr-auth)

15581

THE UTILIZATION OF SOLUBLE NICKEL–MOLYBDENUM AND NICKEL ANODES IN PREPARATION OF NICKEL–MOLYBDENUM ALLOYS FROM ALKALI ELECTROLYTES. D. P. Zosimovich and N. F. Bogatova (Inst. of General and Inorganic Chemistry, Academy of Sciences, Ukrain SSR). Zhur. Priklad. Khim. 31, 429-34(1958) Mar. (In Russian)

It is shown that a wide range of anode densities (30 to 100 ma/cm^2), a constant nickel content in the electrolyte can be maintained by dipping the anodes and controlling the rate of dissolution by changing the concentrations of chloride ion. Also, it is shown that the higher the anode current density the more chloride ions should be added to the electrolyte for normal dipping of anodes. (R.V.J.)

15582

NUCLEAR REACTOR METALLURGY. Walter D. Wilkinson and William F. Murphy. Princeton, N. J., D. Van Nostrand Company, Inc., 1958. 388p. $5.60.

Some basic aspects of general metallurgy, including alloy theory, phase diagrams, and elementary crystallography, are presented. Uranium ores, production, alloys, metallography, thermal properties, fabrication, corrosion, and radiation effects are described at length. A discussion of the special problems presented by Pu, Th, Be, and Zr is presented. The use of ceramics and liquid metals in reactor technology is discussed. Metallic materials with large cross sections for thermal neutrons and the effects of neutron radiation on nonfissionable alloys are described. (W.L.H.)

15583

APPROXIMATE THEORY OF DEFORMATION AND STRESSES IN WELDING. Galim Bilalovich Talypov. Leningrad, Izd-vo Leningrad, Univ-ta, 1957. 205p.

In this book, intended for scientific workers, engineers, and students, an approximate theory for the determination of welding stresses and strains is presented. The basis of the method is an experimentally derived schematic outline of the process of development of welding deformations. (TCO)

PHYSICS

Refer also to abstract 16064.

15584 AECU-3822

Aeroprojects, Inc., West Chester, Penna.

EVALUATION OF POWER REQUIREMENTS AND MATERIALS FOR ULTRASONICALLY PRODUCING DISPERSIONS OF THORIUM BISMUTHIDE. Progress Report. Sept. 1958. 17p. For Brookhaven National Lab. Contract AT-30-2-Gen-16, Subcontract S-370. (RR-58-49.) $3.30(ph OTS); $2.40(mf OTS).

Progress is reported in the program for investigation of the practicability of an ultrasonic method for redispersing the ThBi platelets formed in Liquid Metal Fuel Reactor slurry during processing for U^{233} recovery. Work on assembly and testing of the ultrasonic furnace array for treating the Th–Bi melt is described, and data from preliminary test runs for the power requirements study are given. (T.R.H.)

15585 HW-55707(Del.)

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

NUCLEAR SAFETY IN PLUTONIUM METAL DISSOLUTION. N. Ketzlach. Apr. 11, 1958. Decl. with deletions May 21, 1958. 17p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

Experimental evidence as well as theoretical considerations are presented which indicate that a plutonium metal–plutonium solution system can be more reactive than either one alone. More experiments as well as further theoretical development are required to achieve a better understanding of such systems. (auth)

15586 ISC-907

Ames Lab., Ames, Iowa.

THERMOMAGNETIC AND GALVANOMAGNETIC EFFECTS. R. D. Redin. Sept. 1957. 22p. Contract W-7405-eng-82. $0.75(OTS).

A review is given of the various transverse thermomagnetic and galvanomagnetic effects. The coefficients and relations between coefficients are listed for both metals and semiconductors. A quantitative analysis is given of the error in Hall effect measurements owing to non-isothermal conditions. (auth)

15587 MLM-CF-58-7-19

Mound Lab., Miamisburg, Ohio.

NUCLEAR BATTERY—THERMOCOUPLE TYPE. Quarterly Progress Report No. 6 [for] April 1, 1958 to June 30, 1958. B. C. Blanke. June 30, 1958. 11p. DA Project No. 3-99-15-102. Contracts AT-33-1-GEN-53. and R-65-8-99811-SC-01-91. $3.30(ph OTS); $2.40(mf OTS).

A thermoelectric generator having independent outputs of 1.2 and 4.8 volts at more than 50 milliwatts after six month's service has been constructed and tested using a mock Po^{210} heat source with an initial thermal power of 37 watts. (For preceding period see MLM-CF-58-4-49.) (auth)

15588 NP-6902

Joint Inst. for Nuclear Research, Moscow. Lab. of Theoretical Physics.

ON THE INDEFINITE METRIC IN QUANTUM FIELD THEORY. N. N. Bogoliubov, B. M. Medvedev, and M. K. Polivanov. 1958. 16p.

Heisenberg has suggested that the Lehmann–Kallen theorem would break down if the physical states with positive norm do not form a complete system in the Gilbert space of states, but must be completed by the non-physical states, the norm of which may also be negative. Some of the possibilities arising in the theory when this indefinite metric is introduced are discussed. (D.E.B.)

15589 NP-6904

Joint Inst. for Nuclear Research, Moscow. Lab. of Theoretical Physics.

ON A CLASSICAL MODEL OF INDEFINITE METRIC. B. V. Medvedev and M. K. Polivanov. 1958. 10p.

A method of using indefinite metric in the quantum field theory was suggested in a previous paper (NP-6902) by N. N. Bogoliubov and authors. The purpose of this note is to explain the meaning of the suggested approach by considering an instructive analogy in the framework of the classical field theory. (auth)

15590 NP-6920

American Consulate General, Frankfurt Am Main. Science Office.

GERMAN SCIENCE BULLETIN NO. 29–30. Aug.–Sept. 1958. 54p.

Brief reports of research in Germany are given. (T.R.H.)

15591 NYO-6486(MH-VII)

New York Univ., New York. Atomic Energy Commission Computing Facility.

NOTES ON MAGNETO-HYDRODYNAMICS. VII. FLUID DYNAMICAL ANALOGIES. A. A. Blank and Harold Grad. July 15, 1958. 15p. Contract AT(30-1)-1480. $3.30(ph OTS); $2.40(mf OTS).

There are a number of instances for which combined fluid and electromagnetic equations are mathematically identical to those of classical fluid dynamics. The existence of these analogies permits the application of known results in fluid dynamics to fluid magnetics. Examples are presented in the form of mathematical descriptions of parallel flows, two-dimensional transverse flows, conservation of circulation and Bernoulli's law, and one-dimensional transverse flow. (D.E.B.)

15592 SCTM-231-58(51)

Sandia Corp., Albuquerque, N. Mex.

SURVEY OF POSSIBLE EXPLOSIVE-ELECTRIC ENERGY TRANSDUCERS. Stuart E. Whitcomb. July 30, 1958. 49p. Contract AT(29-1)-789. $7.80(ph OTS); $3.30(mf OTS).

Transducing mechanisms are discussed for the conversion of the mechanical, thermal, or electromagnetic energy liberated by an explosive into a short duration pulse of electrical energy. The explosives considered are heat powders, propellants, and high explosives. The transducer effects discussed are limited to those involving no rotating parts and a minimum of moving mass. Over twenty effects which might be utilized are defined and discussed briefly. An extensive bibliography is included for each effect. (auth)

15593 SCTM-264-58(14)

Sandia Corp., Albuquerque, N. Mex.

THE RELATION OF SURFACE CLEANLINESS TO THE INSULATION RESISTANCE OF ETCHED WIRING CARDS. R. P. Noble. July 24, 1958. 23p. Contract AT(29-1)-789. $4.80(ph OTS); $2.70(mf OTS).

A method of testing etched cards for surface cleanliness was developed. The effects of exposing etched cards to atmospheres of various relative humidities were studied, and the possibility of using this test method in production is discussed. (auth)

15594 AEC-tr-2727

KINETIC THEORY OF THERMOOSMOSIS. (Thermodiffusion through Membranes.) Karl Wirtz. Translated for Atomics International from Z. Naturforsch. 3a, 380-6(1948). 13p.

Between two spaces of different temperature which are filled with the same gas or liquid, and which are separated by a permeable membrane, a pressure difference establishes itself which depends on the diffusing substance and on the nature of the membrane. Considerations about the diffusion steps at the membrane surface and in the membrane show the relationship between this "thermoosmosis" and the "transfer heat," i.e., the heat which the particle transfers from the one to the other space as it migrates through the membrane. From thermodynamic considerations laws are deduced which are kinetically derived by transposition considerations for specific cases. It is found that only the transfer heat upon passage through the membrane surface is responsible for the thermoosmosis, not within the membrane. In specific cases the transfer heat is identical with the heat of solution of the liquid in the membrane, and it would then in principle be determinable by means of caloric measurements of an entirely different nature. (auth)

15595 AEC-tr-2733

TRANSPOSITION PROCESSES IN LIQUIDS. Karl Wirtz. Translated for Atomics International from Z. Naturforsch. 3a, 672-90(1948). 43p.

The quasi-crystalline model of liquids explains the continually changing position in space of every particle and gives information about the mean path length traveled in a sudden movement which it makes relative to its neighbors. It is also shown that the properties of the liquids can all be expressed by laws which essentially contain the number of transpositions of one particle per second as well as the mean length of transposition. A bibliography is included. (J.R.D.)

15596 AEC-tr-3274

ON THE VELOCITY OF RISE AND HYDRAULIC RESISTANCE OF GAS BUBBLES IN LIQUIDS. B. K. Kozlov and M. A. Mologin. Translated by Michael Roman (Westinghouse Electric Corp.) from Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk, 1188-97 (1951). 19p.

Results of an investigation on the determination of velocity of rise of air bubbles in water and the determination of how their resistance coefficients depend upon the dispersion of bubbles and the diameter of the tubes in which the experiments were performed are presented. (W.L.H.)

15597 AEC-tr-3360

MEASUREMENT OF THE DIFFUSION COEFFICIENT AND SOLUBILITY OF HYDROGEN IN ALUMINUM AND IN COPPER. W. Eichenauer and A. Pebler. Translated by K. S. Bevis (Savannah River Lab.) from Z. Metallk. 48, 373-8(1957). 15p.

Diffusion coefficients of hydrogen in aluminum and copper were determined from degassing curves, using equipment developed for this particular purpose. The solubility of hydrogen in the metals was calculated from the measurements. For spheres and cylinders of 99.5% aluminum, the diffusion coefficient was $D = 0.21 \exp(-10900/RT)$ and the solubility coefficient was $L = 0.027 \exp(-19400/RT)$, in the 470 to 590° temperature range. Results of corresponding measurements on electrolytic copper spheres in the 270 to 650° range were $D = 0.011 \exp(-9200/RT)$ for the diffusion coefficient and $L = 0.00084 \exp(-8600/RT)$ for the solubility coefficient. The exact validity of Sievert's square-root law for the solubility of hydrogen in copper could be derived from measurements at 432, 558, and 630°C. A discussion of the results, particularly with respect to the good agreement of the diffusion coefficients for specimens of different shapes as well as the independence of the diffusion process from the loading pressure, indicate that diffusion can be considered as a rate process. (auth)

15598 NP-tr-141

ON THE STATISTICAL NATURE OF THE IONOSPHERE. Ia. L. Alpert and A. A. Ainberg. Translated by M. Balser and M. Loewenthal (Lincoln Lab., MIT) from Zhur. Eksptl'. i Teoret. Fiz. 21, 389-400(1951). 21p.

The electromagnetic field of a single signal reflected from the ionosphere is considered as the resultant of the superposition of a regular signal and a large number of "elementary" signals scattered by inhomogeneities in the ionosphere, the motion and changes of which have a chaotic character. Formulas are inferred for β^2 (the

ratio of the energy of the regular signal to the energy of the elementary signals) and v_0 (the root mean square velocity of these motions and changes which characterize the degree of inhomogeneity (turbidity) of the reflecting layer). Results of experiments are cited which show that reflection from the F_2 layer almost always has a statistical character, with β^2 ranging from $\beta^2 \sim 0$ to $\beta^2 \sim 50$, and v_0 within the limits 0.5 to 15 m/sec. The magnitudes of β^2 and v_0 change during the course of a day. (auth)

15599 NP-tr-142

ESTIMATE OF THE CAPACITY OF CERTAIN REAL COMMUNICATION CHANNELS. I. A. Ovseevich and M. S. Pinsker. Translated by Morris D. Friedman (Lincoln Lab., MIT) from Radiotekhnika 13, 15-25 (1958). 18p.

The capacity is estimated of a real communication channel with parameters fixed in time, a channel for which the time variations of the parameters have the shape of white noise, and a channel which is a combination of the first two. It is shown by examples that the results obtained are a generalization of the known case of Sunde and Feinstein. (auth)

15600 SCL-T-41

THEORY OF HYSTERESIS PHENOMENA IN BARIUM TITANATE. (Theoria Gisterezisnykh Yavlenii v Titanate Baria.) L. P. Kholodenko. Translated by M. I. Weinreich (Sandia Corp.) from Kristallografiya 1, 393-402(1956). 14p.

This study analyzes the dependence of the polarization on field intensity and temperature for barium titanate above and below the point of transition from the paraelectric to the dielectric state. An explanation of the "double hysteresis loops" is also given. (auth)

15601

NEUTRON SOURCE FOR SIMPLE EXPERIMENTAL TESTS. Wolfdietrich Schneider. Atomwirtschaft 3, 270-3(1958) July. (In German)

A small, inexpensive neutron source which is easy to operate and suitable for experimental demonstrations was designed. It consists of a Ra–Be source in a metal cylinder with built-in heavy metal shielding. A thick paraffin layer surrounds the source during operation. (J.S.R.)

15602

THE KINEMATIC VISCOSITY OF LIQUID HELIUM II. A. D. B. Woods and A. C. Hollis Hallett (Univ. of Toronto). Can. J. Phys. 36, 1125-6(1958) Aug.

15603

HEAT TRANSFER IN THE CONDENSATION OF METAL VAPORS: MERCURY AND SODIUM UP TO ATMOSPHERIC PRESSURE. Balabhadra Misra and Charles F. Bonilla (Columbia Univ., New York). Chem. Eng. Progr. Symposium Ser. 52, No. 18, 7-21(1956).

The condensing heat transfer coefficients of metal vapors were studied. The coefficients for mercury were determined by condensing mercury on cooled vertical copper plated steel, carbon steel, nickel, stainless, and nickel–stainless–carbon steel composite condensers. The coefficients for sodium were determined using a bimetallic nickel–stainless steel condenser. Various calculational methods give results that place Δt across a liquid metal condensate film much higher than indicated by theory, pointing to an unexpected thermal resistance at the solid-liquid interface. (J.R.D.)

15604

EQUILIBRIUM IONIZATION OF PARTICLES. A. A. Arshinov and A. K. Musin. Doklady Akad. Nauk S.S.S.R. 120, 747-50(1958) June 1. (In Russian)

A general solution is derived for the problem of equilibrium ionization of particles involving all incidents from the multiple ionization of atoms to the ionization of macroscopic particles. (R.V.J.)

15605

TEMPERATURE RISE VS CURRENT RISE OF ETCHED WIRING LINES. R. P. Noble (Sandia Corp., Albuquerque, N. Mex.). Elec. Mf. 6p.(1958) July.

The test techniques and interim data on etched wiring lines indicate a more practical design use than was possible with data previously available. A nomograph useful for epoxy-glass laminate printed-wiring boards is included. (auth)

15606

CALCULATING GAS-TURBINE PERFORMANCE. RAPID METHOD FOR FINDING CONDITIONS OF OPTIMUM EFFICIENCY. W. R. Hawthorne and G. de V. Davis (Univ. of Cambridge, Eng.). Engineering 361-5 (1956) May 18.

A method is described for estimating the performance of gas-turbine cycles with varying degrees of intercooling, reheating, and regeneration. For given temperatures and component efficiencies it is shown that the pressure ratios for optimum efficiency and work, and the values of optimum efficiency, etc., can be rapidly determined by a graphical method. Some examples illustrating results obtained with the method are included. (auth)

15607

THE PROTON COMPTON WAVELENGTH AS THE 'QUANTUM' OF LENGTH. L. S. Levitt (Stevens Inst. of Tech., Hoboken, N. J.). Experientia 14, 233-4(1958).

The majority of the experimental lengths concerning the fundamental forces in the nucleus are integral multiples of the Compton wave length λ_0 of the proton, where $\lambda_0 = \hbar/m_0c = 1.32 \times 10^{-13}$ cm (which could thus be called a "compton"). These lengths include the effective range of interaction of nucleons and the dispersion amplitudes. It was found, by different methods, that the radius of unity R_0 of the nucleus lies between 1.0 and 1.5×10^{-13} cm. It appears then that the true radius of the proton can well be its Compton wave length. (tr-auth)

15608

UNUSUAL TEMPERATURE DEPENDENCE OF BROMINE QUADRUPOLE RESONANCES IN $TiBr_4$. R. G. Barnes and R. D. Engardt (Iowa State Coll., Ames). J. Chem. Phys. 29, 248-9(1958) July.

The nuclear quadrupole resonance spectrum of bromine was detected and measured in $TiBr_4$. The temperature dependence of the resonance frequencies was determined from data points obtained between 77°K and room temperature. In addition, the pressure dependence at room temperature to 10,000 psi was determined. The resonance frequency depends on pressure through direct volume dependence of the field gradients, and through the volume dependence of the vibration amplitudes which in turn average the field gradients. (J.R.D.)

15609

SOLUTIONS IN SULPHURIC ACID. PART XXIV. ELECTRICAL CONDUCTIVITY, CRYOSCOPIC, AND DENSITY MEASUREMENTS ON SOLUTIONS IN DIDEUTEROSULPHURIC ACID. R. H. Flowers, R. J. Gillespie, J. V. Oubridge, and C. Solomons (University Coll., London). J. Chem. Soc. 667-74(1958) Feb.

Freezing points, and the densities and electrical conductivities at 25°, of the system D_2O-SO_3 were measured in the region of the composition D_2SO_4 and of solu-

tions of $KDSO_4$ and $NaDSO_4$ in 100% D_2SO_4. Some conductivities of the D_2O-SO_3 system and of solutions of $KDSO_4$ were also measured at 10 and 40°. The freezing point of D_2SO_4 is 14·35° ± 0·02°, its cryoscopic constant is 6·5, its specific conductance is $2·568 \times 10^{-3}$ ohm^{-1} $cm.^{-1}$, and its density is 1·8573. From the results of the cryoscopic measurements the extent of self-dissociation of the solvent, and equilibrium constants for the reaction of D_2O and $D_2S_2O_7$ with the solvent were calculated. The degree of ionization of m-nitrotoluene in D_2SO_4 was also investigated. (auth)

15610

SELECTIVE ELECTROLYTIC ETCHING OF GERMANIUM AND SILICON JUNCTION TRANSISTOR STRUCTURES. I. A. Lesk and R. E. Gonzalez (General Electric Co., Syracuse, N. Y.). J. Electrochem. Soc. 105, 469-72(1958) Aug.

The electrolytic dissolution of germanium and silicon has been applied to the selective etching of n-p-n and p-n-p junction transistor structures. By employing the electrical properties of p-n junctions internal to the pellet as well as the electrolytic behavior of the n- and p-type germanium or silicon, part of the emitter or collector (or both) of a transistor pellet may be etched away, leaving the rest of the pellet intact. The resulting exposure of part of the base region may be used to locate the base region and facilitate attachment of the transistor base lead. (auth)

15611

THE MOBILITIES OF THE IONS IN FUSED KNO_3-AgNO_3 MIXTURES. F. R. Duke and Boone Owens (Iowa State Coll., Ames). J. Electrochem. Soc. 105, 476-7(1958) Aug.

The mobilities of the three ions in fused KNO_3-AgNO_3 mixtures have been determined as a function of composition. The mobility of the nitrate ion is insensitive to composition changes; the cations, however, tend toward the mobility of the main constituent cation at each end of the composition scale. Temperature variation has no significant effect on the transport numbers of these ions. (auth)

15612

ELECTROLUMINESCENCE OF ZINC SULFIDE PHOSPHORS AS AN EQUILIBRIUM PROCESS. Willi Lehmann (Westinghouse Electric Corp., Bloomfield, N. J.). J. Opt. Soc. Am. 48, 647-53(1958) Sept.

The intensity of the time-average output of the steady-state electroluminescence of powdered zinc sulfide phosphors in an intense alternating electric field is characterized by a dynamic equilibrium between the monomolecular collision excitation process and the bimolecular recombination process. This equilibrium condition permits predictions of the dependence of the emission intensity, the efficiency, and other properties on several parameters such as the voltage, the temperature, and the concentrations of electron traps and activator centers. These predictions are compared with experimental results. (auth)

15613

TRANSMITTANCE AND REFLECTANCE OF CESIUM IODIDE IN THE FAR INFRARED REGION. Earle K. Plyler and Nicolo Acquista (National Bureau of Standards, Washington). J. Opt. Soc. Am. 48, 668-9(1958) Sept.

Prisms of cesium iodide can be used to 56μ, and the measurements were made on a small grating spectrometer. The stray radiation of the instrument was less than 2% and the transmittance in the regions of absorption could be measured accurately. The reflection of cesium iodide increases rapidly at wavelengths greater than 120μ. A single reflection from a plate of the material is useful as a filter system from 120 to 170μ. The radiant energy was reflected from 3 plates in order to obtain a sharp maximum. The maximum wavelength was observed at 145μ. (J.E.D.)

15614

THE ELECTRONIC STRUCTURE OF THE TRANSITION METALS AND THEIR ALLOYS AND OF THE HEAVY METALS. J. Friedel (Physique des Solides, Sorbonne). J. phys. radium 19, 573-81(1958) June. (In French)

The electronic structure of the transition metals, such as Fe, Co, Ni, or Pd, dissolved in ordinary metals such as Al or Cu are described. On this basis the electronic structures of the rare earth metals and the actinide metals are discussed. (J.S.R.)

15615

DIELECTRIC CONSTANT OF DEUTERIUM OXIDE. Cyrus G. Malmberg. J. Research Natl. Bur. Standards 60, 609-12(1958) June.

An equal ratio-arm, capacitance-conductance bridge operated at frequencies below 100 kc was used to measure the dielectric constant of deuterium oxide with an accuracy of 0.1% or better in the range 4 to 100°C. A value of 77.94 was found for the dielectric constant at 25°C. The data fit the relation $\epsilon = 87.48_2 - (0.40509)t + (9.638 \times 10^{-4})t^2 - (1.333 \times 10^{-6})t^3$, with a maximum deviation of less than 0.01 unit in dielectric constant. These values were obtained by using a sample having a deuterium oxide content of 99.38 mole %. Deviation of these values from those for pure deuterium oxide, as a result of isotopic contamination, is estimated to be less than 0.005 unit. Some aspects of the temperature dependence of the dielectric constant and of that of a macroscopic polarization are discussed. (auth)

15616

ELECTROLUMINESCENCE FROM THE SURFACE LAYER OF $BaTiO_3$, $SrTiO_3$, AND ASSOCIATED MATERIALS. George G. Hardman (National Bureau of Standards, Washington and Univ. of Maryland, College Park). Phys. Rev. 111, 27-33(1958) July 1.

Electroluminescence resulting from high-frequency excitation (≳500 kc/sec), has been observed in $BaTiO_3$, $SrTiO_3$, and associated materials. It is shown that the light emission is the result of a high r-f field across a thin surface barrier. The efficiency of this emission is very low, and a tentative value of 10^{-6}% was obtained. A model involving field emission from the metal electrode into the crystal surface layer is proposed to explain the observed phenomena. The characteristics of this surface layer are relatively insensitive to temperature, from at least −40°C to 300°C. The ratio of permittivity to thickness, ϵ/L, was found to have a value of $\leq 1.4 \times 10^5$ cm^{-1} for the $BaTiO_3$ surface layer. (auth)

15617

PHASE TRANSITION IN SOLID MERCURY. C. A. Swenson (Iowa State Coll., Ames). Phys. Rev. 111, 82-91(1958) July 1.

A polymorphic transition in solid mercury which was initially discovered by Bridgman has been studied at lower temperatures and pressures than those previously used. The transition would occur at zero pressure and 79°K if these data are extrapolated. However, the transition begins to show time effects and large pressure hysteresis at much higher temperatures, and below 93°K it can only be made to run irreversibly and in the $\alpha-\beta$ direction, and then only upon the application of several thousand atmos pressure. The changes in the molar volume with both temperature and pressure from

4.2 to 200°K and from zero to 12,000 atm. have been determined in addition to the changes in the thermodynamic parameters at the transition. In particular, these results can be used to explain an anomaly which was found in work on the effects of pressure on the superconducting transition in mercury. (auth)

15618

OPTICAL ABSORPTION AND PHOTOEMISSION OF BARIUM AND STRONTIUM OXIDES, SULFIDES, SELENIDES, AND TELLURIDES. R. J. Zollweg (Westinghouse Research Labs., Pittsburgh). Phys. Rev. 111, 113-19(1958) July 1.

Considerable structure has been observed at the intrinsic optical absorption edge of annealed films of BaO, BaS, BaSe, BaTe, SrO, SrS, SrSe, and SrTe at −160°C. Photoemission measurements allow an estimate to be made of the energy separation between the top of the valence band and the vacuum level. (auth)

15619

RADIATIONLESS RECOMBINATION IN PHOSPHORS. Leon Bess (RCA Labs., Princeton, N. J.). Phys. Rev. 111, 129-32(1958) July 1.

An Auger-type process is proposed for a possible means of nonradiative annihilation of free holes at electron traps in phosphors. A rough calculation is made of the cross section for the process, and some of the consequences are considered qualitatively. (auth)

15620

SUPERCONDUCTING TRANSITION IN ALUMINUM. John F. Cochran and D. E. Mapother (Univ. of Illinois, Urbana). Phys. Rev. 111, 132-42(1958) July 1.

Further results on the superconducting properties of aluminum are given which supplement those previously reported. The critical field curve for pure Al has been measured by using a paramagnetic salt as a thermometer. Except for a region very near T_c, our data are accurately represented by the parabolic relation, $H_c = H_0[1-(T/T_c)^2]$, where $T_c = 1.196 \pm 0.005$°K and H_c is about 99 ± 1 gauss. The excellent reproducibility of the S-N transition in Al suggests that it may serve as a useful secondary thermometric standard near 1°K. Further observations are reported on the broadening tendency of magnetically measured transitions in single-crystal specimens near T_c. It is also found that polycrystalline specimens of the same material do not show the broadening effect. A semiquantitative theory of the intermediate state is applied to explain the observation that the magnetic transition is sharper than predicted on the basis of specimen geometry at temperatures well below T_c. The difference in sharpness can be explained as a contribution of the interphase free energy whose order of magnitude has been estimated with fair success from the observed shape of the magnetic transition. (auth)

15621

ELASTIC AND PIEZOELECTRIC COEFFICIENTS OF SINGLE-CRYSTAL BARIUM TITANATE. Don Berlincourt and Hans Jaffe (Clevite Research Center, Cleveland). Phys. Rev. 111, 143-8(1958) July 1.

Mechanical resonance and antiresonance frequencies were measured on barium titanate single-crystal elements maintained under electric d-c bias from −50 to +150°C. A complete set of elastic, piezoelectric, and dielectric constants of the tetragonal modification at 25°C is obtained. The elastic compliances show substantial deviation from cubic symmetry. Measurements in the orthorhombic state show longitudinal compliance four times higher than in the tetragonal state. (auth)

15622

PRESSURE STUDIES ON THE NUCLEAR MAGNETIC RESONANCE OF SOLID HYDROGEN BETWEEN 1.2° AND 14°K. G. W. Smith and C. F. Squire (Rice Inst., Houston Texas). Phys. Rev. 111, 188-93(1958) July 1.

The nuclear magnetic resonance spectrum of solid hydrogen (75% ortho) has been studied as a function of temperature from 1.2 to 14°K and of pressures from one to three hundred atmospheres. At 10°K the absorption signal broadens from less than one gauss to 5.3 gauss between slope extrema as the temperature is lowered and self-diffusion ceases. When pressure is applied, this broadening is shifted to higher temperatures by a sizable amount. With 230 atmospheres, a shift of 3.2°K was observed. Correlation times and activation energies of self-diffusion have been computed for each of the transitions at various pressures. The activation energies are linearly dependent upon the transition temperatures. The lower transition at 1.5°K in which some rotational degeneracy is removed was also investigated with various pressures. Pressures up to 216 atmospheres did not shift the transition temperature to any observable extent. Pressures up to 337 atmospheres had no effect on line shape below 1.5°K. (auth)

15623

METHODS OF MEASURING STRONG MAGNETIC FIELDS. J. L. Symonds (Univ. of Birmingham, Eng.). Repts. Progr. in Phys. 18, 83-126(1955).

Descriptions which are briefly theoretical and essentially practical are given of a number of the techniques of magnetic field measurement, used or developed in the period of about twenty years since the last review of the subject. Particular attention is given to the application of the phenomenon of magnetic resonance while other subjects discussed are magneto-resistance, Hall effect, peaking strips, the generator principle and various fluxmeters. The uses which are made of the force exerted on a current-carrying conductor in a magnetic field are given though some of these are not, strictly speaking, field measurements. The measurement of the position of the magnetic median plane of a magnet is discussed. The last paragraphs are devoted to a description of a few methods which do not find very wide application. A list of about 150 references is appended. These are classified in groups under the heading of each particular method. (auth)

15624

ARTIFICIAL SATELLITES. Ario Abramovich Shternfel'd. Moscow, Gostekhizdat, 1958. 295p. (In Russian)

This book, intended for the general reader, stresses problems of celestial mechanics and rocket engineering, which are the basic steps in satellite development. As the book was published immediately after the launchings of the first Sputniks, it does not include all the recent scientific developments connected with these launchings. Problems of remote control, radio communication, and physiology are given secondary consideration. (J.S.R.)

15625

LECTURES IN ATOMIC PHYSICS. VOLUME I. Johannes Picht. Berlin, Veb Deutscher Verlag der Wissenschaften, 1956. 244p. (In German)

As the results of physics must be treated statistically, the book on atomic physics first discussed the principles of statistics and the basic equations of mechanics. These serve as an introduction to the basic laws of statistical mechanics. The fundamental laws of heat

radiation are next discussed and introduce the discussion of light quanta and radiation theory. The construction and radiation of atoms and molecules and the periodic system of elements are described. The book closes with a discussion of Bose-Einstein and Fermi-Dirac statistics. (J.S.R.)

Aerosols

15626 NYO-4615

Harvard Univ., Boston. Air Cleaning Lab.
MECHANISMS IN ELECTROSTATIC FILTRATION OF AEROSOLS WITH FIXED AND FLUIDIZED GRANULES. David M. Anderson and Leslie Silverman. Aug. 31, 1958. 148p. Contract AT(30-1)-841. $22.80(ph OTS); $7.20(mf OTS).

With fibrous media, success has been limited because of the difficulty of friction-charging fibers deep within the filter mass. It is shown that granular media are more easily handled and triboelectrified. Furthermore, these media can also be fluidized, i.e., the filter beds can be expanded by the aerosol stream to be filtered, such that flow resistance remains constant after initial expansion, thus bringing filtration power requirements into a region competitive with fiber filters and other cleaning devices. Electrostatic collection forces besides those due to charged collector surfaces also operate in any filter and are due to electric image effects produced by charged aerosols. A convenient grouping of all electrostatic filtration forces is as follows: (1) those arising from the charges residing on the aerosol particles; (2) those arising from the charge residing on the filter element; and (3) those arising from interaction of aerosol and filter surface charge. The effects of these forces were studied using conducting and dielectric granular beds in both the fixed and fluidized states. The dielectric media tested (polystyrene) had surface charge generated by in situ charging using especially designed matrix system, contact-separation charging occurring between fluidized granules and interspersed conducting wires, and by remote charging using a vibrating cylindrical lucite trough. The test aerosol (gentian violet microspheres) was charged to a low level by the generation of droplets containing the dye from a spinning disk. Filtration effects were tested in an exploratory way at the start of the study using polystyrene granules with atmospheric dust as the test aerosol. The results indicated that a surface charge density of 0.09 esu/cm^2 on these granules raised the filtration efficiency (strain method) from a fixed bed unchanged (net) level of 64% to 96% for fluidized beds expanded to 120% of the original bed depth, thus obtaining better performance in conjunction with greater air handling capacity at no increase in flow resistance. An economic evaluation of the performance data was made which indicated that charged fluidized mixtures of polystyrene with opposite charging characteristics will filter five times as efficiently as grounded conductor media and at the same time handle over twice as much as volume at equivalent resistance. Comparison of the performance of such beds with available commercial air cleaning devices indicated that a competitive system is now available at a possibly reduced cost. (A.C.)

Astrophysics

15627

FORMATION OF ELEMENTS IN THE STARS. Margaret Burbidge and Geoffrey Burbidge (Univ. of Chicago, William Bay, Wis.). Science 128, 387-99 (1958) Aug. 22.

Recent developments in nuclear physics and in both theoretical and observational astrophysics pertaining to an understanding of the formation of elements in the stars are reviewed. (C.H.)

15628

RARE GASES AND THEIR ISOTOPIC DISPLACEMENT IN THE TREYSA IRON METEORITE. W. Gentner, H. Fechtig, and G. Kistner (Univ. of Freiburg i. Br.). Z. Naturforsch. 13a, 569-70(1958) July. (In German)

Cosmic radiation could cause an alteration in the isotopic ratios of He^3/He^4 or Ar^{36}/Ar^{38}. This isotopic effect might be detectable in the Treysa iron meteorite. A disk approximately 9 cm in diameter was available from this meterorite. It was divided into 12 sections and approximately 10 g taken from each. The samples were melted, and the gases were separated. An isotopic analysis was made, and the results for Ar, Ne, and He are tabulated. (J.S.R.)

Cosmic Radiation

15629 NP-6893

Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.
NUCLEAR INTERACTIONS IN THE ENERGY REGION 10^{10} eV–10^{14} eV. Report No. 30/VI. P. Ciok, T. Coghen, J. Gierula, R. Holynski, A. Jurak, M. Miesowicz, T. Saniewska, and J. Pernegr. June 1958. 22p.

In interactions of nucleons of cosmic radiation with the nuclei of photographic emulsion (with $N_h \leq 5$) in the limits of energy 10^{10} to 10^{14} ev the angular distributions of secondary particles in the C.M. approximated by Gaussian curves show an increase in anisotropy with energy in agreement with the predictions of the Landau theory. It was found, however, that in many high energy jets the angular distribution quite markedly departs from the angular distribution predicted by the theories of Landau and Heisenberg in their present form. This is also reflected in the total differential distribution by a dip in the vicinity of the angle $\pi/2$ in the C.M. The two-center model that has been introduced by Takagi seems to describe the shape of the angular distribution in the C.M. with better agreement with experiment. In this model it is assumed that the secondary particles are emitted isotropically with the same energy from two centers moving in the C.M. with $\bar{\gamma}$ considerably less than the γ of the nucleons. The two-centers model permits the factor $\bar{\gamma}$ of the centres in C.M. to be related to the coefficient of inelasticity, multiplicity, energy of secondary particles in the system of the center, and the energy of the primary nucleon. From this relation and from the observed angular distributions the values of the transversal momentum obtained are in agreement with experiment. (auth)

15630

MEASUREMENT OF COSMIC RADIATION ON THE SPUTNIK. S. N. Vernov, N. L. Grigorov, Yu. I. Logachev, and A. E. Chudakov. Doklady Akad. Nauk S.S.S.R. 120, 1231-3(1958) June 21. (In Russian)

Preliminary data obtained from the apparatus placed in the second artificial satellite are presented. (R.V.J.)

15631

ON THE ENERGY DETERMINATION OF THE HEAVY PRIMARIES. C. M. Garelli, B. Quassiati, and M. Vigone (Univ. of Turin and Istituto Nazionale di Fisica

Nucleare, Turin). Nuovo cimento (10) 8, 731-9(1958) June 1.

The formula suggested by Peters for the energy determination of the heavy primaries, requires the knowledge of the mean energy of evaporation of the α particles. The present work establishes that this energy depends slightly on the size of the evaporating nucleus. (auth)

15632

A CASE OF DOUBLE PAIR PRODUCTION BY AN ELECTRON. C. Castagnoli and A. Manfredini (Univ. of Rome and Istituto Nazionale di Fisica Nucleare, Rome). Nuovo cimento (10) 8, 778-80(1958) June 1.

During the scanning of emulsions exposed at 25 km altitude, an event was found which is interpreted as simultaneous creation of two pairs by an electron. A reproduction of the tracks is shown. (D.E.B.)

15633

IDENTIFICATION OF FAST HEAVY NUCLEI OF THE COSMIC RADIATION USING NUCLEAR EMULSION TECHNIQUES. B. J. O'Brien and J. H. Noon (Univ. of Sydney). Nuovo cimento (10) 8, 807-25(1958) June 16.

Measurements were made of six parameters of tracks of nuclei with $4 \leq Z \leq 9$ in a stack of G-5 stripped emulsion flown at 41°N geomagnetic latitude. The δ-ray, blob, and isolated-grain densities, the Fowler-Perkins coefficient, integral gap length, and probability of development have been found for each track. Estimates have been made of the effect of various sources of error in these measurements, including a study of the change in each measured parameter with a 20% change in minimum grain density of the emulsion. From the comparison and analysis of these measurements, recommendations are given on the use of the above techniques in the identification of fast heavy nuclei in nuclear emulsion. (auth)

15634

THE INTENSITY AND ANGULAR DISTRIBUTION OF MU-MESONS 1100 FEET UNDERGROUND. C. A. Randall (Ohio Univ., Athens) and W. E. Hazen (Univ. of Michigan, Ann Arbor). Nuovo cimento (10) 8, 878-81 (1958) June 16.

The results of the determination of the intensity and angular distribution of the μ mesons at a depth of 8.5×10^4 g/cm^2 underground are $I = I_0 \cos^n\theta$ with $I_0 = (2.10 \pm 0.5) \times 10^{-6}$ s^{-1} cm^{-2} sr^{-1} and $n = 2.3 \pm 0.3$. The significance of the results in determining the parentage of the μ mesons is discussed. (auth)

15635

THE THIRD SOVIET ARTIFICIAL EARTH SATELLITE. INVESTIGATION RESULTS ON THE INTENSITY OF COSMIC RADIATION. L. V. Kurnosova (Lebedev Inst. of Physics, Moscow). Priroda No. 6, 85-6(1958). (In Russian)

Variations in the cosmic radiation intensity showed that at the 700 km altitude the intensity increases about 40% in comparison to the intensity at 200 km. The number of recorded particles changes slowly with greater distances from the earth. At 1500 km the increase in intensity is about 15%. Data on the particle number dependence on longitude and latitude indicate that the lines of cosmic-ray intensity do not coincide with geomagnetic lines. (R.V.J.)

15636

BROADENING EFFECT OF THE NUCLEON AND MESON COMPONENTS OF COSMIC RADIATION AT SEA LEVEL IN THE INDIAN AND ATLANTIC OCEANS. S. Skorka (Institut für Reine and Angewandte Kernphysik, Kiel, Germany). Z. Physik 151, 630-45(1958). (In German)

During a voyage from Europe to Australia the cosmic radiation intensity was measured. The broadening effect of the nucleon component was 1.78 in the Atlantic and 1.99 in the Indian Ocean. The corresponding values of the meson component are 1.13 and 1.16. The deviations of the spatial intensity distribution from that expected from the eccentric earth dipole and the good agreement of the measurements with the earlier measurement of Rose et al. (Can. J. Phys. 34, 968(1956)) were noted. (tr-auth)

15637

THE TRANSITION EFFECT OF COSMIC NEUTRONS AT THE AIR–WATER INTERFACE. E. Bagge and S. Skorka (Christian Albrechts-Universität, Kiel, Germany). Z. Physik 152, 34-48(1958). (In German)

The neutron density in a fresh water lake at sea level was measured between 0 and 140 cm in depth with three BF_3 counters (92% enrichment). At a depth of 4.6 ± 0.3 cm a transition maximum was found which increased five-fold relative to the value of the neutron intensity measured at the water surface. The thermal flux over water, measured as the Cd difference, is $(0.90 \pm 0.02) \times 10^{-3}$ n/cm^2 sec. At 50 cm, the transition effects have disappeared; the neutron flux begins to decrease exponentially with an average absorption length of 169^{+19}_{-16} g/cm^2. The total local production rate at sea level, measured in water, is $(2.89 \pm 0.09) \times 10^{-5}$ n/g sec. (tr-auth)

Crystallography and Crystal Structure

Refer also to abstracts 15672, 15974, and 15975.

15638 NAA-SR-2770

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

CREEP AND ANELASTIC STUDIES OF Al_2O_3. Roger Chang. Sept. 1, 1958. 24p. Contract AT-11-1-GEN-8. $0.75(OTS).

Measurements have been made of the activation energy for "steady-state" creep and of the variation of internal friction and dynamic elastic constants with temperature of single crystals and polycrystals of Al_2O_3 containing various amounts of Cr_2O_3 or La_2O_3 in solid solution. The activation energy for "steady-state" creep in the temperature range 1500 to 1950°C is shown to be about 8.5 ev for all the specimens studied regardless of grain size and of chemical composition. The activation energy for grain boundary relaxation in Al_2O_3 is approximately 8.5 ev. Addition of Cr_2O_3 or La_2O_3 lowers considerably the activation energy for grain boundary relaxation, decreasing the grain boundary viscosity at a given temperature. The results are discussed in terms of the current theories of high-temperature creep and grain boundary slip in crystalline solids. (auth)

15639

DETERMINATION OF THE PRINCIPAL AXES OF THE ANISOTROPIC TEMPERATURE FACTOR. William R. Busing and Henri A. Levy (Oak Ridge National Lab., Tenn.). Acta Cryst. 11, 450-1(1958) June.

The equations recently derived by Waser may be recast two ways, offering computational advantages. These arrangements are discussed and demonstrated mathematically. (J.R.D.)

15640

REVISED LATTIC CONSTANTS AND POWDER PATTERN FOR $YFeO_3$. S. Geller (Bell Telephone Labs., Inc., Murray Hill, N. J.). Acta Cryst. 11, 565-6(1958) Aug.

A very pure sample of $YFeO_3$ was prepared by coprecipitation techniques, and the lattice constants measured a = 5.280, b = 5.592, c = 7.602 ± 0.003 A. These values reduced by about 0.02 A the previously published values for a and c. Diffraction data, using CrK radiation, are included. (D.E.B.)

15641

WORK FUNCTION AND SORPTION PROPERTIES OF SILICON CRYSTALS. J. A. Dillon, Jr., and H. E. Farnsworth (Brown Univ., Providence). J. Appl. Phys. 29, 1195-1202(1958) Aug.

The work functions of silicon single crystals have been obtained by measuring the contact potential differences between the crystals and a gold reference whose work function was measured by the Fowler method. The measurements were carried out in high vacuum ($p < 10^{-9}$ mm Hg). For nonfloating-zone silicon, the work function was higher for samples which were radiation quenched from 990°C than it was for samples which were annealed at 500°C. This effect was not observed for floating-zone material and was presumably a function of occluded oxygen. The work functions for the different faces after ion-bombardment cleaning were in the sequence (100) > (110) > (111). The values after quenching were: (100), 4.92 ev; (110), 4.89 ev; (111), 4.77 ev. The values after annealing were: (100), 4.82 ev; (110), 4.70 ev; (111), 4.67 ev. The work function of the (111) face of a 2000-ohm-cm, p-type, floating-zone sample was 4.73 ev after quenching or annealing. Changes in both surface and volume properties were observed when silicon was heated above 1000°C in contact with quartz. Oxygen exposures of 5×10^{-5} mm Hg min resulted in work function increases which were larger on the annealed surfaces than on the quenched ones. This was observed for both floating-zone and oxygen-doped material and is therefore a property of the silicon itself. Photoelectric evidence indicated a diffusion of oxygen into the silicon (1) when silicon was heated in oxygen, (2) when silicon was heated at 990°C in high vacuum after O_2 adsorption, and (3) when silicon with residual surface films from chemical etching was heated at 990°C prior to ion bombardment. Hydrogen exposures of 7.5×10^{-4} mm Hg min resulted in work-function decreases only in the presence of a heated filament. Nitrogen exposures of 4×10^{-8} mm Hg min resulted in no work-function changes. Heating silicon in high vacuum at 990°C for about 100 hours developed thermal-etch patterns which were rectangular on the (100) face, hexagonal on the (110) face, and triangular on the (111) face. Heating at 1080°C for 24 hours caused further etching which developed the same triangular patterns on the (111) face but left the (100) and (110) faces with a sandblasted appearance. (auth)

15642

ULTRASONIC MEASUREMENT OF POLARIZATION SWITCHING PROCESSES IN BARIUM-TITANATE SINGLE CRYSTAL. K. Husimi and K. Kataoka (Nippon Telegraph and Telephone Public Corp., Tokyo). J. Appl. Phys. 29, 1247-51(1958) Aug.

A previously developed nondestructive piezoelectric method for studying the state of polarization of ferroelectric crystals is applied to study polarization switching in barium titanate single crystals. Three polarization processes are proposed. The first and second processes were designated nucleation and growth by Merz. The third process cannot be measured by conventional pulse methods, and has a very slow polarizing velocity. This indicates the existence of layers which lie between the surface layer and inner layer. Switching time results are considered in the light of the above experiments. (auth)

15643

GROWTH OF PREFERENTIALLY ORIENTED ALUMINUM SINGLE CRYSTALS. Theodore H. Orem. J. Research Natl. Bur. Standards 60, 547-9(1958) June.

Monocrystalline aluminum specimens having both a preferential orientation and a specified cross-sectional shape are very difficult to produce. Such specimens must be grown in a vertical furnace, a condition which, while permitting the choice of cross-sectional shape in the specimen, makes it extremely difficult to obtain specimens of preferred orientation. It is fairly easy to grow preferentially oriented monocrystalline aluminum specimens when a horizontal furnace is used, but the use of such a furnace limits the choice of cross-sectional shapes in the finished crystal. Crystals of circular cross-sectional shape are practically impossible to grow in a horizontal furnace. The method described herein can be used to grow monocrystalline aluminum crystals with any desired orientation or cross-sectional shape. (auth)

15644

OPTICAL TRANSMISSION AND PHOTOCONDUCTIVE AND PHOTOVOLTAIC EFFECTS IN ACTIVATED AND UNACTIVATED SINGLE CRYSTALS OF ZnS. George Cheroff and Seymour P. Keller (I.B.M. Corp., Poughkeepsie, N. Y.). Phys. Rev. 111, 98-102(1958) July 1.

Certain physical properties of single crystals of ZnS and of ZnS activated with Mn, Cu, and Al have been determined. The optical studies involve transmission spectra. Photovoltages much larger than the energy gap have been measured. Reversals in the sign of the voltage have been measured as a function of the wavelength of incident light. The photovoltages and photocurrents have been determined as functions of wavelength and of intensity of incident light. A description is presented in which the characteristics of the crystals are treated as simple circuit elements. (auth)

15645

RADIATIVE ENERGY TRANSFER IN ZnS. R. E. Halsted, E. F. Apple, and J. S. Prener (General Electric Research Lab., Schenectady, N. Y.). Phys. Rev. Letters 1, 134-6(1958) Aug. 15.

The results indicate that there are radiative emission and absorption processes which overlap in most ZnS-type materials. An example of a radiative energy transfer process is presented. (W.D.M.)

15646

CORRELATION AND THE ISOTOPE EFFECT FOR DIFFUSION IN CRYSTALLINE SOLIDS. A. H. Schoen (Univ. of Illinois, Urbana). Phys. Rev. Letters 1, 138-40(1958) Aug. 15.

It is suggested that the dependence of the diffusion coefficient on the isotopic mass of the diffusant is a function of the correlation between the directions of consecutive jumps of a diffusing atom. (W.D.M.)

15647

PRECISION MEASUREMENT OF THE LATTICE CONSTANTS IN GERMANIUM SINGLE CRYSTALS ACCORDING TO KOSSEL AND VAN BERGEN. Günther Mack (Universität Tübingen, Germany). Z. Physik 152, 19-25 (1958). (In German)

The measurement of the lattice constants of single crystals of germanium, made according to the compensation method of Kossel and van Bergen, with $NiK\alpha_1(\lambda = 1.65782\ A)$ at a crystal temperature of 20.00°C, gave the following results:

purest material	$a_{20} = 5.65735 \pm 0.00005$ A.
low resistant material	$a_{20} = 5.65731 \pm 0.00008$ A.

The uncertainties given are the maximum research errors. The greatest systematic uncertainty is based on the wave length values and is comparable to the maximum research error. In comparison with the measurements of other authors it is shown that differences in the dispersion theories used are noticeable in the last place. The application of a uniform dispersion theory is necessary. After conversion to the Honl form of the Kallmann-Mark dispersion theory, agreement was obtained with the measurements of Straumanis and Aka, as well as Smakula and Kalnajs. (tr-auth)

15648

SUPERSTRUCTURE IN THE ELECTRON DIFFRACTION DIAGRAM OF MICA CRYSTALS. Otto Rang (Physikalisch Laboratorium, Mosbach, Germany). Z. Physik 152, 194-202(1958). (In German)

Observations on the electron diffraction diagram of mica are reported which show in addition to a honeycomb structure an abundance of distinct supplementary reflections. The honeycomb structure follows directly from the opposite distortion of two layers of the crystal at 13.18°, while the supplementary reflections are a result of a double lattice reflection in the mutually distorted crystal layers. The idea of a virtual elementary cell as the "reason" for the supplementary reflection was discussed with respect to its importance for electron interferometry. (tr-auth)

Electrical Discharge

Refer also to abstract 15778.

15649 AECD-4263

SHERWOOD REPORT—NO UNCLASSIFIED DISTRIBUTION OR ANNOUNCEMENT UNTIL SEPTEMBER 13, 1958.

Los Alamos Scientific Lab., N. Mex.

TURBULENT PINCH EXPERIMENTS. G. A. Sawyer and T. F. Stratton. [1957?]. Decl. Apr. 23, 1958. 28p. Contract [W-7405-eng-36]. $4.80(ph OTS); $2.70(mf OTS).

Studies were made of the quasi-stable pinch produced by a relatively long duration low voltage capacitor discharge (5ms, 3kv) in a 600 cm long, 15 cm diameter metal tube. Current-voltage characteristics, spectra and magnetic probe measurements were the most productive instrumental techniques for the study of gas temperature, stability, and wall material contamination. The magnetic field distributions obtained with the magnetic probes showed an interesting regularity in time and space for certain values of gas density, gas current, and applied axial magnetic field. It was possible to obtain complete current distributions for this case from the measurements of the three components of magnetic field. The current distribution was found to have a helical notch of reduced current density and the distribution rotated with an angular velocity of 20,000 revolutions per second. The helical regularity may be a hydromagnetic wave of the Alfven type. (auth)

15650 AERE-READING LIST-5

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

A SELECTED READING LIST ON CONTROLLED THERMONUCLEAR REACTIONS. C. S. Sabel, comp. Aug. 1958. 6p.

References (56) to recent available literature are divided into popular and technical categories. (D.E.B.)

15651 CF-58-4-24

SHERWOOD REPORT—NO UNCLASSIFIED DISTRIBUTION OR ANNOUNCEMENT UNTIL SEPTEMBER 13, 1948.

Oak Ridge National Lab., Tenn.

HIGH ENERGY STEADY STATE INJECTION INTO THERMONUCLEAR DEVICES: THE LUCE IGNITION SCHEME. Albert Simon. [Apr. 1958]. 11p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

The Luce Ignition Scheme is essentially the injection of an energetic molecular ion across a magnetic field where it is dissociated, the resulting ion, retaining half the original momentum, being trapped and used in the production of a plasma. The basic theory of this scheme and some of its apparent advantages are discussed. (D.E.B.)

15652 NARF-58-36T

Convair, Fort Worth, Tex.

FAST-RESPONSE LINEAR MICRO-MICROAMMETER. J. R. Gardner. Aug. 20, 1958. 18p. Project 6(1-9964). Contract AF33(600)-32054. (MR-N-181).

A prototype fast-response linear micromicroammeter has been developed which uses the 100 percent-feedback type of circuit without the usual dc-to-ac input converter. The circuit consists basically of an ORNL electrometer and a new type of push-pull magnetic amplifier. The output impedance of the electrometer matches the input impedance of the magnetic amplifier. The magamp output is fed back to the electrometer input to obtain fast response time (<0.1 sec) and negligible drift. The accuracy of measurement depends on the values of input and feedback resistors, and voltage gain is eliminated as a measure of accuracy and linearity. The ranges of current measurement extend from 10^{-11} amperes full scale to 5×10^{-6} amperes full scale, in 18 steps. (auth)

15653 NYO-8060

SHERWOOD REPORT—NO UNCLASSIFIED DISTRIBUTION OR ANNOUNCEMENT UNTIL SEPTEMBER 13, 1958.

Princeton Univ., N. J. Project Matterhorn.

THE CONDITIONS FOR THE TRANSITION OF MAGNETIC SURFACES BETWEEN HELICAL AND CIRCULAR REGIONS. Technical Memorandum No. 58. W. Stanley Brown, Martin Kruskal, and Carl Oberman. Jan. 30, 1958. Decl. May 19, 1958. 41p. Contract AT(30-1)-1238. $7.80(ph OTS); $3.30(mf OTS).

Conditions on a bounding magnetic surface are determined, in a thin tube approximation, such that the interior vacuum magnetic surfaces can be concentric circular cylinders at one end of a tube and helically symmetric at the other end. It is shown that if these conditions are satisfied, then the interior surfaces approach their limiting form at either end almost as rapidly as the boundary surface. (auth)

15654 NYO-8672

New York Univ., New York. Atomic Energy Commission Computing and Applied Mathematics Center.

SHERWOOD PROGRESS REPORT NO. 2 [FOR] JULY 1957 TO JULY 1958. H. Grad and J. Berkowitz.

July 31, 1958. 15p. Contract AT(30-1)-1480. $3.30 (ph OTS); $2.40(mf OTS).

In shock theory, investigation has been concerned with a range of parameters in which a low-temperature, low β plasma is heated to a much higher temperature at a moderate β by a shock of moderate strength. In computing the perturbation of the ion distribution, mathematical methods of computing the tail end of the distribution were developed which may have applications to runaway electrons. A very complete set of transport coefficients was computed for a fully ionized gas. The validity of the Boltzmann and Fokker-Planck equations was studied. The constancy of the magnetic moment μ was demonstrated to all orders. Techniques were developed for solving by approximate means self-consistent field problems of much more generality than are accessible by exact means. A large number of mirror machine geometries with end plates was analyzed for stability using a simple sufficient condition. Methods of computing three-dimensional cusped geometries both analytically and numerically are being investigated. Experimental equipment constructed and installed is described. (For preceding period see NYO-7968.) (W.D.M.)

15655 RISÖ-2

Denmark. Atomenergikommissionen. Forsøgsinstitut, Risø.

SOME CRITERIA FOR A SELF-SUSTAINING STEADY STATE THERMONUCLEAR REACTION. T. Hesselberg Jensen, O. Kofoed-Hansen, A. H. Sillesen, and C. F. Wandel. May 4, 1958. 21p.

A thermonuclear reaction in a plasma is thought to be kept in a steady state by continuously adding cold deuterium and tritium, and at the same time extracting part of the plasma. In general it is necessary to reinject a fraction, ϵ, of the power escaping from the plasma in form of electromagnetic radiation, kinetic energy of neutrons, and heat in extracted plasma. ϵ turns out to be only a function of the plasma temperature, the burn-up of deuterium and the tritium enrichment of the fuel. Only cases with 0 and 9.1% tritium in the feed are investigated. By varying burn-up and temperature an absolute minimum for ϵ is found in each case. For pure deuterium fuel $\epsilon_{min} \simeq +0.04$ at a temperature $kT \simeq 80$ kev and 30% burn-up. For the tritium enriched case $\epsilon_{min} \simeq -0.07$ at $kT \simeq 20$ kev and 8% burn-up. Breeding ratios and burn-up efficiencies for tritium are also investigated and characteristic reaction times for conditions optimizing ϵ are given. (auth)

15656 NP-tr-128

IONIZATION AND RECOMBINATION PROCESSES IN A PLASMA AND THE IONIZATION EQUATION FOR THE SUN'S CORONA. G. Elwert. Translated by R. C. Murray (U.K.A.E.A. Atomic Energy Research Establishment) from Z. Naturforsch. 7a, 432-9(1952). 21p.

If a plasma is not in thermodynamic equilibrium, the number of elementary ionization and recombination processes must be known to enable its degree of ionization to be calculated. These are on the one hand photo-ionization and ionization by electron impact, and on the other recombination with emission of light quanta and three-body collisions. Equations are given for each of these four processes. Impact ionization and photo-recombination are discussed in detail. By equating their numbers an improved ionization equation is obtained for the sun's corona, from which, with the aid of the known intensity ratio of the green and red corona lines, the temperature of the corona can be estimated. The accuracy of this temperature determination is assessed. (auth)

15657

APPLICATION OF SIMPLE WAVES TO THE INVESTIGATION ON NON-STATIONARY, ISENTROPIC, COMPRESSIBLE DISCHARGES. Julian Bonder. IX^{e} Congr. intern. Mécan. Appl. 3, 85-94(1957). (In French)

It is shown how the study of a remarkable class of exact solution of gas dynamics (non-stationary, isentropic, compressible discharges) can be made on the basis of classical analysis. The method of characteristics is used for the integration of the differential system to which the generalized simple waves, tridimensional and non-stationary, are subjected. Certain general properties of this class of discharge are analyzed and the results are applied to the examination of plane discharges caused by a non-stationary movement of a dihedral. The conditions of the deformation of the shock waves in the discharge are discussed. (J.S.R.)

15658

A METHOD FOR DETERMINING THE MEAN KINETIC ENERGY OF ELECTRONS IN THE CASE OF DRUYVESTEYN–DAVIDOV DISTRIBUTION. H. Rotman (Physico Mathematical Dept. of Bucharest Univ., Rumania). Doklady Akad. Nauk S.S.S.R. 120, 999-1002 (1958) June 11. (In Russian)

Calculations were made in order to determine the existence of Druyvesteyn–Davidov rate distributions in plasma, and to determine the kinetic energy of electrons, potential of the plasma, and the number of charge carriers for 1 cm^3. (R.V.J.)

15659

RESEARCH ON CONTROLLED THERMONUCLEAR FUSION AT SACLAY. II. Jean Charon. Ind. Atom. 2, No. 7-8, 115-23(1958). (In French)

The French research on controlled thermonuclear fusion is described. The approach has been both theoretical and experimental. The experimental work done on the heating and containment of the gas by means of high-intensity discharge in straight and toroidal chambers is discussed. The results are compared with the results obtained in other countries. (J.S.R.)

15660

CONTROLLED THERMONUCLEAR FUSION–WHAT IT MEANS TO THE RADIO ENGINEER. E. W. Harold (RCA Labs. and C. Stellerator Associates, Princeton, N. J.). IRE National Convention Record Part 9, 3-10 (1958).

The major features of thermonuclear fusion for power purposes are discussed, and a review of the present status of research is presented. (W.D.M.)

15661

HYDROMAGNETIC STABILITY. Ira B. Bernstein (Princeton Univ., N. J.). IRE National Convention Record Part 9, 11-13(1958).

A brief description is given of the physical nature of the hydromagnetic stability problem for proposed thermonuclear reactors. (W.D.M.)

15662

NEUTRON PRODUCTION IN A LINEAR PINCH. Oscar A. Anderson and Robert V. Pyle (Univ. of California, Berkeley). IRE National Convention Record Part 9, 19-26(1958).

The neutron-producing linear pinch devices that were built at Berkeley are described, and the experiments pertaining to a possible thermonuclear process are discussed. It was finally shown that the neutrons were produced by plasma instabilities. (auth)

15663

PLASMA MOTORS. Wijston H. Bostick (Stevens Inst. of Technology, Hoboken, N. J.). IRE National Convention Record Part 9, 28-36(1958).

An experiment proposed to measure the plasma momentum by the ballistic pendulum method is described. The disadvantages of button-type guns are discussed. A simple analysis is presented that gives a relatively easy way of assessing the effect of various parameters in rail-type plasma motors without the laborious task of numerical integration of the equations of motion. Considered are the series plasma motor, a combination series-shunt plasma motor, rotary shunt plasma motor, and a barrage of button guns. (W.D.M.)

15664

NEUTRON GENERATION FROM STRAIGHT PINCHES. R. E. Dunway and J. A. Phillips (Los Alamos Scientific Lab., N. Mex.). J. Appl. Phys. 29, 1137-43(1958) Aug.

Experiments on the neutrons produced in deuterium gas during a high-current pulsed discharge are described. With 15-kv applied to a straight discharge tube 30 cm long, neutrons are produced during a 0.1 μsec pulse ~1.4 μsec after gas breakdown. The yield of 10^7 to 10^8 neutrons per discharge depends on gas purity and the discharge tube wall material. The axial asymmetry in neutron energy indicates that the neutrons are produced in reactions whose center of mass moves preferentially towards the cathode. (auth)

15665

STUDY OF THE EFFECT OF A MAGNETIC FIELD ON THE INTENSITY OF THE RADIATION EMITTED BY SOME DISCHARGE TUBES. O. Tardy and M. R. Lennuier (Laboratoire des Recherches Physiques de la Sorbonne, Paris). J. phys. radium 19, Suppl. No. 7, 75A-83A(1958) July. (In French)

The action of a magnetic field on the intensity of lines radiated by some gaseous discharge tubes is studied. In several thousands of gauss, an important increase in the intensity of the radiations is observed. The increase is not generally the same for all the lines radiated by a given tube; the electric power consumed by it also increases, but in a lesser ratio, in such a way that the luminous efficiency increases by a factor of about 2. (tr-auth)

15666

THE EFFECT OF A TRANSVERSE MAGNETIC FIELD ON THE CONSECUTIVE LAYERS IN THE GLOW DISCHARGE. A. Rutscher (Univ. of Greifswald, Germany). Naturwissenschaften 45, 54(1958). (In German)

The effect of a transverse magnetic field on the consecutive layers in the glow discharge in rare gases was investigated. By use of a revolving mirror whose axis lies parallel to the discharge tube, the positive pole can be observed so that the consecutive layers can be detected in a wise current and pressure range. Only a part of the positive pole is placed in a homogeneous transverse magnetic field. In the space between the magnetic poles the velocity and the layer distances, in contrast with that in the field free space, vary considerably. The velocity, the layer distances, and the frequency of the consecutive layers are shown as a function of the strength of the magnetic field. (J.S.R.)

15667

PLASMA LOSS FROM MAGNETIC BOTTLES. E. Persico (C.N.R.N., Rome) and J. G. Linhart (CERN, Geneva). Nuovo cimento (10) 8, 740-53(1958) June 1.

The various shapes of magnetic fields devised in order to confine a plasma (magnetic bottles) always allow leakage for different reasons. One of the most important of these losses is that due to particles gliding along the lines of magnetic force. A general method is proposed for evaluating approximately this loss, and it is applied to two particular kinds of magnetic bottles. (auth)

15668

EFFECT OF ELECTRON EXCHANGE ON THE DISPERSION RELATION OF PLASMA OSCILLATIONS. Hideo Kanazawa (Univ. of Tokyo) and Sho-ichiro Tani (Kaisei High School, Tokyo). Progr. Theoret. Phys. (Kyoto) 19, 153-8(1958) Feb.

An investigation is made concerning the influence on the dispersion relation of plasma oscillations of the electron exchange which has been left as an open question since the work of Bohm and Pines. The dispersion relation is derived by adopting a canonical transformation which is a little different from that of Bohm and Pines. The result obtained shows that the electron exchange gives a small contribution to the Bohm-Pines' dispersion relation. Results are compared with those given recently by Ferrell using the Hartree-Fock self-consistent method. (auth)

15669

INVESTIGATIONS ON THE SHORT ALTERNATING CURRENT ARC IN AIR. PART I. Heinz Nöske (Siemens-Schuckertwerke AG, Berlin). Z. angew. Phys. 10, 327-36(1958) July. (In German)

The dependence of the reinitiation capacity of a 50-Hz alternating current arc between metal electrodes on various research parameters was investigated. The arc voltage and current, intensified by a special direct current amplifier, were recorded with a two-beam oscillograph. The behavior of the arc during quenching or reinitiation could be divided into various typical groups, in which the processes were statistically distributed with frequent switchings. The distribution depends on the research parameters such as the contact material, contact distance, steepness and height of the recovery voltage, and the switching number. By a suitable selection of the research parameters it can be established that the more statistical character for the reinitiation behavior was obtained until at more favorable arrangements (e.g., smaller cathodes and appropriate electrode material) quenching always occurred. The electrical, chemical, and thermal properties of the oxide layer deposited on the electrode surface is shown as important for the influence of the various electrode materials and the quenching behavior. Also the appearance of secondary currents was influenced by the oxide layers. In the secondary current flow it is still uncertain whether a reinitiation or quenching of the arc follows. Therefore a decrease of the secondary current does not mean that a quenching will occur. On the other hand one can estimate each case of reinitiation if, in the excited secondary current, the arc voltage assumes a temporarily constant value corresponding to a high pressure glowing arc. The increase of the peak forming on the electrode surface was investigated using Cu electrodes in which the peaks have a spherical shape. Agreement was obtained with the results of a heat conduction calculation. (tr-auth)

15670

NEUTRON EMISSION OF HIGH CURRENT DEUTERIUM DISCHARGES. E. Fünfer, H. Herold, G. Lehner, H. Tuczek, and C. Andelfinger (Technischen Hochschule, Munich). Z. Naturforsch. 13a, 524-31(1958) July. (In German)

A 40 μf condenser bank of 40-kv maximum was discharged over a discharge vessel 50 cm in length and

20 cm in diameter and filled with very pure deuterium. The current intensity was more than 100 kamp, the current rise time was 0.63×10^{12} amp/sec, and the length of a quarter period was 2.5×10^{-6} sec. A repeated compression of the plasma occurred through the pinch effect, which was detected by current and voltage measurements. As a result of the compression, neutrons appeared, whose total number was determined by activation measurements to a maximum of 10^7 per discharge. These neutrons originate from a deuterium fusion process. The moment of their formation was determined with a fast scintillation counter and correlated with the breaks appearing in the current flow. The luminescences appearing in the plasma compression were investigated with a Kerr cell camera, so that in individual cases a plasma hollow cylinder contracting with velocities of 10^7 cm/sec on the axes was observed. Because of the relative long length of the neutron pulse of approximately 2.5×10^{-6} sec, the sensitivity of the neutron intensity toward foreign gas, and the lack of a hard x irradiation, it could be assumed that at least partially thermal equilibrium must have occurred. Under these assumptions an estimation of the plasma temperature was made by various methods. With consideration of the uncertainties of these assumptions, a temperature of some 10^6°K is not improbable. (tr-auth)

15671

1958 IRE NATIONAL CONVENTION RECORD. PART 9. MEDICAL ELECTRONICS; NUCLEAR SCIENCE. New York, The Institute of Radio Engineers, Inc., 1958. 80p. $6.00.

The papers from session 10 of the Institute of Radio Engineers national convention are presented. Papers are included on controlled thermonuclear fusion, hydromagnetic stability, microwave measurements in controlled fusion research, neutron production in a linear pinch, production of intense magnetic fields, and plasma motors. (W.D.M.)

Electrons

15672 NP-tr-138

ON THE INTERACTION OF ELECTRONS WITH LATTICE VIBRATIONS. S. V. Tiablikov and V. V. Tolmachev. Translated by Morris D. Friedman (Lincoln Lab., MIT) from Zhur. Eksptl'. i Teoret. Fiz. 34, 1254-7(1958). 6p.

A question is considered of the stability of the lattice, taking interaction of electrons with the phonon field into account. A stability criterion is established which does not rely on perturbation theory. (auth)

15673

ROCKET MEASUREMENTS OF ELECTRON CONCENTRATION IN THE IONOSPHERE BY MEANS OF AN ULTRASHORT WAVELENGTH DISPERSION INTERFEROMETER. K. I. Gringauz. Doklady Akad. Nauk S.S.S.R. 120, 1234-7(1958) June 21. (In Russian)

Data are presented on electron concentrations in the ionosphere measured by high-altitude geophysical rockets in 1954 to 1958. One rocket in 1958 reached the elevation of 473 kn. (R.V.J.)

15674

LIBERATION OF ELECTRONS BY FAST NEUTRAL HELIUM ATOMS FROM A TUNGSTEN TARGET. H. W. Berry (Syracuse Univ., N. Y.). J. Appl. Phys. 29, 1219-25(1958) Aug.

The electron emission from tungsten by bombarding helium atoms of energy ranging from 300 to 3500 ev has been measured for a surface with less than a monolayer and with multilayers of adsorbed gas. The yield expressed in electrons per particle rises almost linearly from about zero at 300 ev to 0.42 electrons/particle at 3500 ev for a monolayer of adsorbed gas. Further adsorption of gas gives a much increased yield. These yields are compared with the ion under like conditions. The distributions of the normal velocity and a component of the tangential velocity are compared for the ion and neutral atom on hot and cold targets. (auth)

15675

MEASUREMENT OF THE ABSORPTION IN GRAPHITE OF ELECTRONS FROM MUON DECAYS. W. Kusch (Lódź Univ., Poland). Nuovo cimento (10) 8, 762-4 (1958) June 1.

Measurements were made of absorption in graphite of electrons from muon decays, and the result is compared with the calculated absorption curves. It seems that the difference between the theoretical and experimental results is due mainly to the neglect, for low energies, of the increase in path caused by scattering and relativistic energies of the radiation loss. (A.C.)

15676

DOUBLE SCATTERING OF ELECTRONS. H. Schneider and E. Barnard (Council for Scientific and Industrial Research, Pretoria). Nuovo cimento (10) 8, 770-2(1958) June 1.

Experimental values of asymmetry in double electron scattering seem to be only half the value predicted by theory. It therefore seems worthwhile to improve the experiment if possible and to extend the measurements to $\theta = 90°$. To overcome the difficulties of multiple scattering, only one counter was used at the transmission side of the second scattering foil. To monitor this detector, a second counter was introduced which measured the scattered particles coming from the reflection side of the first foil. After a ten-hour run, the counting rate remained constant within 1%. Alignment was clocked with test runs using hydrocarbon foils, and the asymmetry was found to be within the statistical error. The asymmetry of gold-gold was then measured, and the results are presented. (A.C.)

15677

THE DIRECT PRODUCTION OF ELECTRON PAIRS BY ELECTRONS. G. Lütjens (Max-Planck-Institut für Physik, Göttingen, Germany). Z. Naturforsch. 13a, 510-14(1958) July. (In German)

The frequency of the direct production of electron pairs (the so-called triple forks or tridents) and the energy spectra of the originating electrons were measured in nuclear emulsions. Electrons artificially accelerated to 800 ± 50 Mev were used as primary particles. The total and differential effective cross sections for the direct pair production, determined from the measurements, are compared with the results of the Bhabha theory. It is shown that the theory described the measurements satisfactorily. (tr-auth)

15678

THE ENERGY–RANGE RELATION FOR MONOENERGETIC FAST ELECTRONS. H. Breuer, D. Harder, and W. Pohlit (Max-Planck-Institut für Biophysik, Frankfurt am Main). Z. Naturforsch. 13a, 567-8(1958) July. (In German)

In the determination of the energy-range relationship for monoenergetic fast electrons, a 35-Mev betatron was used as the source. The threshold values for the (γ,n) reaction in Cu^{63}, O^{16}, and C^{12} were used to determine the energy of the source electrons. For the deter-

mination of the electron range in aluminum for various electron energies an absorption curve was plotted from theoretical and experimental data. The maximum range in aluminum is shown as a function of the energy. The relation $R_{max} = 0.246\ E$, where R is the range in cm in Al and E is the energy in Mev, was obtained. The relation is valid for 10 Mev < E < 23 Mev. (J.S.R.)

15679

ENERGY LOSS AND SCATTERING OF FAST ELECTRONS IN Be, C, AND Al. B. Ziegler (Technischen Hochschule, Karlsruhe, Germany). Z. Physik 151, 556-62(1958). (In German)

The average and probable energy loss and the half-width of the energy distribution were measured in Be, C, and Al for 32-Mev electrons. The results for the average energy loss agreed very well with theory. The most probable energy loss and especially the half-width of the scattering distribution shows deviations which are too large with increasing atomic number, which are probably traceable to too great simplifications in the solution of the transport equation. (tr-auth)

15680

INTENSIVE MEASUREMENT OF DISCRETE ENERGY LOSSES BY 35 kev ELECTRONS IN GASES. W. Dietrich (Universität Tübingen, Germany). Z. Physik 152, 87-97 (1958). (In German)

The anomalous energy broadening in primary electron radiation detected by H. Boersch in high beam current densities was verified using an improved electrostatic rate analyzer working in the caustic beam. On this basis a resolution range of 0.25 ev with electrons from the barium oxide cathode (T = 1460°K) is obtainable only when the beam current is kept very low (2 μamp). At this especially high monochromaticism from 35-kev accelerated electrons, the discrete energy loss in the interaction of the molecules N_2 and O_2 and the atoms He, Ne, Ar, Kr, and Xe was determined. The spectra were resolved into broad lines in contrast with earlier measurements with fast electrons. In the atoms the values found were classified freely in the optical term pattern. (tr-auth)

15681

ON THE STATISTICS OF THE ELECTRON AVALANCHE IN A PLANE FIELD. III. H. Schlumbohm (Univ. of Hamburg). Z. Physik 151, 563-76(1958). (In German)

The fluctuations of the amplification of the carrier numbers of single electron avalanches describe the distribution law $v(n) = (1/\bar{n})e^{-(n/\bar{n})}$, where $\bar{n}$ is the average value of this amplification. This law was verified by experiment. The continuation of the investigation on the statistics of the avalanches gave in the following cases deviations from the foregoing distribution: (a) If the single avalanche is accompanied by successive avalanches, then a modification of the distribution law occurs when the avalanche together with the successor was registered as a total pulse. In the plotting of the frequency distribution this avalanche chain was registered as one avalance with larger carrier numbers. (b) At small pd values (about 1 Torr-cm) the observed distribution shows in small avalanches a deficit in contrast with the normal distribution which can form a maximum in the distribution function. Remarkably these deviations are independent of the kind of gas (oxygen, alcohol, acetone, methane, or methylal) and are describable by the parameter $\kappa = (1/U_i \times E/\alpha)$, where (E/α) is the energy which an electron takes from the field between two ionizing substances, and U_i is the ionization voltage of the gas. (c) In addition, it is shown that at high gas amplifications ($\bar{n} \gtrsim 5 \times 10^6$) a variation of the distribution function occurs which is traceable to a weakening influence of the space charge on the characteristic carrier propagation. A discrepancy between the works of Kojima and Kato (J. Phys. Soc. Japan 11, 322(1956)) and Frommhold (Z. Physik 150, 172(1958)) was explained. The first authors see in the straight-line frequency distribution measured by them a confirmation, although under these conditions successive avalanches occur which change the distribution. The discussion shows that on account of the two narrowly selected carrier number measuring range these deviations could not be detected. (tr-auth)

Gases

15682 UCRL-8230

California. Univ., Berkeley. Radiation Lab. THERMAL CONDUCTIVITY AND VISCOSITY OF GAS MIXTURES (thesis). Henry Cheung. Apr. 1958. 146p. Contract W-7405-eng-48. $22.80(ph OTS); $7.20(mf OTS).

Correlations based upon empirical modified equations derived from kinetic theory were developed for the thermal conductivity and viscosity of gas mixtures. The conductivity equation was compared to 226 binary mixture conductivities in temperatures from 0 to 774°C from the literature and this work. The average deviation is 2.1%. In correlating conductivity data of mixtures of polyatomic molecules, the energy transport is considered in two parts, i.e., one protion transferred by collision and the other by diffusion. The proposed viscosity equation reproduces 103 binary data points with an average deviation of 1.3%. These equations are more consistent with experiment than existing correlations in the literature. The relation of the conductivity or viscosity to composition and temperature are discussed in the light of the proposed equations. It has been demonstrated that, at a given composition, the ratio of the measured conductivity to that calculated on the molar average basis for mixtures of most simple molecules and the ratio of the measured viscosity to that calculated on the molar average basis for mixtures of most gases should be nearly constant over a temperature range of 200 to 300°C. The thermal conductivity of ten gases and selected binary and ternary mixtures of them were measured in a concentric silver cylinder cell in the temperature range of 100 to 540°C. The gases are He, A, N_2, O_2, CO_2, CH_4, C_2H_4, C_3H_8, methyl ether, and methyl formate. (auth)

15683

ON THE THEORY OF PHASE TRANSITION IN A NON-IDEAL BOSE-GAS. D. N. Zubarev and Yu. A. Tserkovnikov (Steklov Inst. of Math., Academy of Sciences, USSR). Doklady Akad. Nauk. S.S.S.R. 120, 991-4(1958) June 11. (In Russian)

A model hamiltonian was used for developing the theory of phase transition in a non-ideal Bose gas and for determining the behavior of the system near the point of the transition. (R.V.J.)

15684

DIFFUSION OF GASES IN POROUS MEDIA. R. F. Dye and J. M. Dallavalle (Georgia Inst. of Tech., Atlanta). Ind. Eng. Chem. 50, 1195-1200(1958) Aug.

Experimental gas diffusion measurements were made at each of a number of porosities using samples of pressed powdered $KClO_4$ of different thicknesses, and CO_2 gas to obtain information for evaluating the solution of the flow pattern equation. During diffusion, the change of concentration with time was observed on each

side of the porous medium, and from these data diffusion coefficients were calculated. Tabulation of the data is included. (J.R.D.)

15685

NOTE ON DIFFUSIVE SEPARATION OF GAS MIXTURES IN FLOW FIELDS. V. C. Liu (Univ. of Michigan, Ann Arbor). J. Appl. Phys. 29, 1188-9(1958) Aug.

The effect of pressure-diffusion flux upon the concentration distribution of gas mixtures in flow fields is discussed. The equation of concentration is formulated for a binary gas mixture in which the mass ratio is large and the concentration of the lighter gas is very small. An asymptotic solution to the steady-state equation of concentration is given for an irrotational and incompressible flow. As an illustration, the diffusive separation (i.e., deviation from the original homogeneous state) of a mixture of helium and nitrogen along streamlines at the entrance to a long straight channel is calculated. It is assumed that the pressure inside the channel is 90% of that in the free stream, and that the diffusion coefficient of the mixture corresponds with the atmospheric conditions at 80-km altitude. (auth)

15686

STUDY OF THE LEVELS OF He^3 BY OPTICAL SPECTROSCOPY AT VERY LOW TEMPERATURES. J. Brochard, H. Chantrel, and P. Jacquinot(C.N.R.S., Bellevue). J. phys. radium 19, 515-22(1958) May. (In French)

The hyperfine structure of He^3 and the isotopic shift $\Delta T(He^4 - He^3)$ in the lines $\lambda\lambda$ = 7065, 4713, 4471, and 3888 A were studied using a double Fabry-Perot etalon spectrophotometer and a hollow cathode usually cooled by liquid helium below the λ point (~1.8°K). The results are tabluated. (tr-auth)

15687

DISSOCIATION AND IONIZATION OF AIR BY A SHOCK WAVE. J. Thouvenin (Agrégé de l'Université). J. phys. radium 19, 639-48(1958) July. (In French)

The composition and internal energy of air are computed for a range of temperature from 3,500 up to 11,500°K and a range of density from 4 to 12 times normal density. In another connection, the increase of internal energy of air by a shock wave traveling through it is evaluated in terms of the same parameters. By adjusting both expressions of energy, a relation between the temperature T and the ratio of molecular volumes V_0/V ahead of and behind the shock front is obtained. The other physical variables, pressure, front velocity, material velocity, and degree of ionization, can then be computed if either of parameters T or V_0/V is known. Conversely, measurement of any one physical variable makes it possible to get values of all the others. Present calculations show the oxygen to be completely dissociated by strong shock waves (velocities above 7,000 m/s), the nitrogen by a rate of 50% higher, and the concentration of free electrons to be over 0.1%. (tr-auth)

15688

FUNDAMENTALS OF GAS DYNAMICS. VOLUME III. HIGH SPEED AERODYNAMICS AND JET PROPULSION. Howard W. Emmons, ed. Princeton, N. J., Princeton University Press, 1958. 758p. $20.00.

The following topics related primarily to aerodynamics are discussed in this volume: equations of gas dynamics, including development of the equations; one-dimensional treatment of both steady-state and non-steady-state gas dynamics; hydrodynamic discontinuity phenomena, covering gas dynamic problems associated with shock waves and other considerations; shock wave interactions; and condensation phenomena in high-speed flows. A section is included devoted to the gas dynamics of combustion and detonation. The final section of this volume is an analysis of the flow of rarefied gases. (W.L.H.)

Instruments

15689 AECU-3812

Los Alamos Scientific Lab., N. Mex.

A HIGH CURRENT COAXIAL PHOTOMULTIPLIER. Neel W. Glass and Paul Rudnick. [1956]. 11p. Contract [W-7405-eng-36]. $3.30(ph OTS); $2.40(mf OTS).

A high-current coaxial photomultiplier tube is designed to be capable of delivering several amperes of approximately linear output current, with a rise time of about one millimicrosecond and an electron current gain in the 10^3 to 10^4 region. (J.E.D.)

15690 AECU-3817

Knolls Atomic Power Lab., Schenectady, N. Y.

ROTATING CONTACTS. L. R. Boyd. [1955]. 3p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS). (M-5701).

A simple device for removing a signal from a continuously rotating magnetic field search coil is described. The principle involves copper contact bands turning in a mercury pool. (T.R.H.)

15691 SCR-21

Sandia Corp., Albuquerque, N. Mex.

P-N JUNCTION THEORY AND THE JUNCTION TRANSISTOR. W. J. Leivo. June 1958. 20p. Contract AT(29-1)-789. $0.75(OTS).

A Lecture Delivered at Sandia Corp., Albuquerque, N. Mex., Aug. 8, 1957.

A theoretical discussion is presented of the P-N junction theory and the junction transistor. A P-N junction is where the two regions of a Ge crystal meet, one side of which is P-type, the other N-type. An NPN junction transistor consists of a single crystal, one end of which is N-type, a middle section which is P-type, and the composite end which is N-type. Silicon and Ge are the semiconductors commonly used. (W.L.H.)

15692

A NOTE ON LOW FREQUENCY SELECTIVE AMPLIFIERS. Al. Fuchs (Israel Ministry of Defence). Bull. Research Council Israel Sect. F 7F, 33-8(1957) Dec.

A common analysis of several methods of selective amplification at low frequencies is given, based on fundamental equations of feedback theory. This analysis leads to the definition of a figure of merit expressing the ability of a given circuit to achieve maximum stable Q at a minimum expense of amplifier gain. (auth)

15693

DIFFERENTIAL ELECTRONIC ANALYZERS. Robert Gabillard (CERN, Geneva). Ind. Atom. 2, No. 7-8, 91-107(1958). (In French)

Experimental mathematics is briefly reviewed. Then the modern differential analyzer is described. The basic circuits used in addition, differentiation and integration, multiplication, and division and in the function generators are given. The interconnection of these circuits is briefly discussed. (J.S.R.)

15694

ATOMIC BATTERIES. V. S. Merkulov. Izmeritelnaya Tekh. No. 2, 94-7(1958). (In Russian)

The design, operational principles, and applications of small atomic batteries are discussed. Descriptions are given of experimental models of atomic batteries using Sr^{90}, T, and Pm^{147}. (TCO)

15695
ADAPTATION OF A FURNACE TO AN X-RAY DIFFRACTOMETER. M. Bernard and J. Jaffray (Laboratoire de Thermodynamique, Clermont-Ferrand). J. phys. radium 19, 616(1958) June. (In French)

The design and construction of an x-ray diffractometer coupled with a furnace so that x-ray-diffraction studies can be made at high temperatures are presented. A temperature of 600°C is possible, and it can be maintained within 1°. (J.S.R.)

15696
TIME-AMPLITUDE CONVERTER WITH A RESOLUTION TIME OF 10^{-10} SECONDS. J. Samueli and A. Sarazin (Inst. d'Etudes Nucleaires d'Alger). J. phys. radium 19, Suppl. No. 7, 109A-10A(1958) July. (In French)

A time sorter which converts delay time into a pulse-height distribution is described. The time resolution of the system is 10^{-10} sec. (tr-auth)

15697
STABILIZATION OF THE GAIN OF PHOTOMULTIPLIERS BY EXTERNAL CIRCUITS. G. Pietri (Laboratoire d'Electronique et de Physique Appliquee). J. phys. radium 19, Suppl. No. 7, 111A-16A(1958) July. (In French)

The extreme speed with which the gain of a photomultiplier tube increases when the voltage of supply increases is a major reason of difficulties when using this tube in experimental physics. A stabilization circuit, both simple in construction and efficient, allows a large extension regarding its various uses, particularly for field prospecting. The conception and performance of such a system are described. (tr-auth)

15698
PRESSURE REGULATION IN GLOVE BOX WORKING. J. M. North (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Eng. 3, 293(1958) July.

A simple and practical proportional control valve is described that gives a definite control of box pressure relative to laboratory pressure. It gives proportional control of both inlet and outlet flows so that the further the box pressure is from its set value the greater is the restoring force. (W.D.M.)

15699
SILICON DIODES IMPROVE REACTOR PERIOD METERS. William K. Brookshier (Argonne National Lab., Lemont, Ill.). Nucleonics 16, No. 8, 108, 110-11, 113(1958) Aug.

The disadvantages of thermionic diodes and pentodes for reactor period methods has lead to the utilization of silicon diodes. The diagram of the input circuit is given to show how silicon diodes are incorporated into the preamplifier. The advantages and disadvantages are discussed. (J.S.R.)

15700
12AX7 MODULATOR UNIT UTILIZING PRINTED CIRCUIT TECHNIQUES. A. D. Middelton and J. M. Stueber (Sandia Corp., Albuquerque, N. Mex.). QST 3p.(1958) May.

A low-power modulator for mobile work or for modulating a small transmitter of any type is described. It can modulate r-f plate inputs up to nearly 20 w, depending on the plate voltage available. (auth)

Isotopes

15701
SHORT-LIVED ISOTOPES OF Pd AND Ag OF MASSES 113-117. J. M. Alexander, U. Schindewolf, and Charles D. Coryell (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 111, 228-36(1958) July 1.

Six new short-lived Pd and Ag isotopes have been isolated from the fission products by fast chemical separations. Their decay properties have been studied by β and γ counting and spectroscopy or by periodic extractions of daughter activities. The nuclides described are: 1.4-min Pd^{113} decaying to 1.2-min Ag^{113m} and 5.3-hr Ag^{113}; 2.4-min Pd^{114} from which 5-sec Ag^{114} was extracted; 45-sec Pd^{115} which decays to about 20-sec Ag^{115m} and 21.1-min Ag^{115}; 2.5-min Ag^{116}; and 1.1-min Ag^{117} which gives rise to the complicated decay chain of Cd^{117} and In^{117}. (auth)

Mass Spectrography

15702
DERIVATIVE MASS SPECTROMETRY. J. H. Beynon, S. Clough, and A. E. Williams (Imperial Chemical Industries, Ltd., Blackley, Manchester, Eng.). J. Sci. Instr. 35, 164-6(1958) May.

Double differentiation of the ion beam in a mass spectrometer is shown to have the same effect on peak shape as reduction to zero width of the inlet and exit slits. When this differentiation is performed by modulation of the accelerating voltage, increase of the modulating amplitude results in effective control of the width of both inlet and exit slits making the spectrometer more versatile since its sensitivity and resolving power are easily controlled. Differentiation by an odd number of times enables the center of a single peak to be located with greater speed and accuracy, thus improving the mass measurements made with the spectrometer. (auth)

15703
THE ELECTRIC MASS FILTER AS A MASS SPECTROMETER AND ISOTOPE SEPARATOR. W. Paul, H. P. Reinhard, and U. von Zahn (Univ. of Bonn). Z. Physik 152, 143-82(1958). (In German)

The resolving power and transmission of the electric mass filter was theoretically discussed as a function of field size and impurity levels. On the basis of these considerations a mass spectrometer with a resolving power of 1500 was built. The experimental testing showed that this value was attainable. The conditions under which the intensity ratios in a mass spectrum were accurately reproducible were studied. The separation of high ionic currents was attained by a modification of previous methods, since an additional high frequency field, which puts ions of predetermined mass in resonance and separates them, was superposed on the stabilized four pole field. With the ion source used a current of 3 ma was obtained. (tr-auth)

Mathematics

15704 AECU-3805
Illinois. Univ., Urbana. Digital Computer Lab. TECHNICAL PROGRESS REPORT. PART I. HIGH-SPEED COMPUTER PROGRAM. PART II. MATHEMATICAL METHODS. PART III. ILLIAC USE AND OPERATION—GENERAL LABORATORY INFORMATION. June 1958. 17p. Contracts AT(11-1)-415; N6ori-07130 and Nonr-1834(15). $3.30(ph OTS); $2.40 (mf OTS).

Work on circuits for high-speed computers, iterative methods for linear equations, and switching circuit theory are reported. The operation and use of Illiac for June are summarized. (For preceding period see AECU-3761.) (W.L.H.)

15705 CNI-1

Italy. Comitato Nazionale per le Ricerche Nucleari, Milan.

UN PROGRAMMA MATRICIALE PER LA RICERCA DELLE CONDIZIONI CRITICHE IN UN REATTORE SFERICO. (A Matrix Program for Investigation into the Critical Conditions in a Spherical Reactor.) S. Albertoni, G. Bortone, B. Faleschini, and C. Tamagnini. Apr. 15, 1958. 22p.

The first part of this report contains the formulation of a scheme for the numerical calculation of spherical reactors to plus regions in the approximation to two groups which is included in the category of the matrical scheme adopted in the calculation of criticality. In the second part is described the program for an arithmetical calculation which is obtained from the scheme proposed in the first part. (tr-auth)

15706 GAT-DM-700

Goodyear Atomic Corp., Portsmouth, Ohio.

IBM PROGRAM FOR ESTIMATING THE AMOUNT OF ERROR DEVELOPED IN THE 650 COMPUTER DURING CALCULATIONS. Thomas B. Patterson. Aug. 29, 1958. 7p. Contract [AT(33-2)-1]. $1.80(ph OTS); $1.80(mf OTS).

The errors accumulating in IBM-650 computations due to estimation of last significant figure in the data used were investigated. A program is given which, through the use of "range numbers," allows answers to be given as plus or minus some error. The program has been test run satisfactorily. (T.R.H.)

15707 NDA-43-2

Nuclear Development Corp. of America, White Plains, N. Y.

THE NUMERICAL INTEGRATION OF THE BOLTZMANN EQUATION. Status Report. J. Certaine, F. Chafets, and M. Kalos. Sept. 30, 1955. 18p. Project NIOBE. For Convair. Contract AF33(038)-2117, Subcontract 28051.

The status of project NIOBE (Numerical Integration of the Boltzmann Equation) as of the end of the contract year 1954-55 is presented. A major fraction of the mathematical analysis of the problem has been completed, and a set of equations in a form suitable for machine computation is given. Programming of the problem for machine computation has started, and preliminary results are presented. In addition, hand computation work useful in delineating the preliminary programming and in supplying numerical checks to be used in debugging the machine code has begun. (A.C.)

15708 NDA-Memo-43-1

Nuclear Development Corp. of America, White Plains, N. Y.

OUTLINE OF A PROPOSED METHOD FOR THE NUMERICAL INTEGRATION OF THE BOLTZMANN TRANSPORT EQUATION. J. Certaine and P. Mittelman. Aug. 9, 1955. 4p. For Convair. Contract AF33(038)-21117, Subcontract 280451.

15709 NP-6911

Aeronutronic Systems, Inc., Glendale, Calif.

CHARACTERIZATIONS OF HYDROGEN ATOM SYSTEMS. VOLUME I. J. T. Jones, Jr., Harris L. Mayer, M. H. Johnson, Sylvan Katz, and Robert S. Wright. June 30, 1958. 49p. Contract Nonr-2361(00). (U-216).

The recombination rate of atomic hydrogen at low temperatures in a strong magnetic field is greatly inhibited by the electrostatic exchange force between hydrogen atoms with parallel spin. The various two-body radiative processes and three-body collision processes are reduced by the repulsive barrier, which keeps the atoms three or more Angstroms apart, to the point where substantially no recombination between spin aligned atoms takes place. However, the magnetic interaction between the proton and electron spin can induce an electron spin flip during the course of a collision. If the spin does flip, the atom forms a molecule in a three-body collision very quickly. Various estimates of the spin flip rate indicate that the lifetime of spin aligned hydrogen is much less than one second. It appears that long term stability can only be achieved by a magnetic field sufficiently strong to saturate the nuclear spins as well as the electron spins. (auth)

15710 NYO-8671

New York Univ., New York. Atomic Energy Commission Computing and Applied Mathematics Center.

APPROXIMATE SOLUTIONS OF STEADY-STATE NEUTRON TRANSPORT PROBLEMS FOR SLABS. Herbert B. Keller. July 1, 1958. 59p. Contract AT(30-1)-1480. $9.30(ph OTS); $3.60(mf OTS).

The neutron transport equation is differenced with respect to all but the spatial variables and the solutions of the resulting systems of ordinary differential equations are studied. For the case of elastic scattering the approximate solution is obtained and its convergence to the exact solution is proven. If very accurate approximations are required the solution may be evaluated by computing machines. It is seen that the present procedure has many advantages over direct numerical integration procedures. For elastic scattering the procedure is just the well-known Wick-Chandrasekhar method. The solution for homogeneous slabs of finite thickness is reduced to the inversion of at most three matrices of small order. The required calculations are easily done on desk computers. A new relation between escape probability and capture fraction is also obtained. (auth)

15711 SCTM-214-58(51)

Sandia Corp., Albuquerque, N. Mex.

USES OF THE TABLE OF THE CIRCULAR COVERAGE FUNCTION. G. P. Steck. July 22, 1958. 29p. Contract AT(29-1)-789. $0.75(OTS).

The circular coverage function is used mainly in problems dealing with bombing accuracy and weapons effects. The purpose of this memorandum is to point out uses of this function in such diverse fields as meteorology, heat transfer, and statistics. (auth)

15712 SCTM-216-56(51)

Sandia Corp., Albuquerque, N. Mex.

STATISTICAL ESTIMATES OF PARAMETERS IN LIFE TEST DISTRIBUTIONS. R. G. Miller, Jr. Nov. 6, 1956. 64p. Contract [AT(29-1)-789]. $10.80(ph OTS); $3.90 (mf OTS).

Models for the constant-voltage life test and the discharge life test for capacitors were constructed, and reliability estimates and confidence regions are obtained. The model for the constant-voltage life test deals with the problem of early failures in capacitors lots. An early failure rate λ_1 is assumed to be in operation up to time T_0 after which a lower failure rate λ_2 is in effect until testing terminates at time T_1. Estimates and confidence regions for λ_1 and λ_2 are obtained for the various cases in which T_0 is known or is known only to the extent that it must lie in a specified interval. From these, an estimate and confidence interval for the reliability of a single capacitor or bank of capacitors are constructed. The model for the discharge life test yields an estimate and

confidence interval for the reliability of a capacitor under normal usage when the test data are the result of over-testing the capacitors at voltages higher than those for normal use. (auth)

15713 AEC-tr-3349

VARIATION METHOD FOR HOMOGENIZATION OF HETEROGENEOUS MEDIUM. L. Trlifaj. Translated by Lydia Venters (Argonne National Lab.) from Atomnaya Energ. 2, 231-9(1957). 18p.

The homogenization of a heterogeneous medium is carried out by means of solution of a variation problem which corresponds to the kinetic equation for diffusion of monoenergetic neutrons. It is established that the constant values of the homogenization of a heterogeneous medium generally depend on a mutual orientation of the density of the neutron flux and on the anisotropy of the heterogeneous medium. In the case when the thickness of the layers which form the heterogeneous medium approach zero, the constant values for homogenization of the heterogeneous medium do not depend on mutual orientation of the density of neutron flux and the anisotropy of heterogeneous medium and they are equal to constant values of a respective homogeneous mixture. Taking into account that the results in this article are obtained by applying the kinetic theory, in contrast with the work in which the elementary theory of neutron diffusion was used, one can accept that they appear to be more correct. (auth)

15714 NP-tr-139

ONE POSSIBILITY OF SOLVING THE PROBLEM OF THE STABILITY OF ELASTIC-PLASTIC PLATES IN AN EXACT FORMULATION. Iu. R. Lepik. Translated by Morris D. Friedman (Lincoln Lab., MIT) from Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk, No. 8, 13-19(1957). 12p.

By starting from flow theory, a variational equation can be constructed for which all the continuity conditions on the interface of the elastic-plastic and purely plastic regions are automatically satisfied. Results found on the basis of deformation and flow theories are in agreement in the case of slightly developed plastic deformations. The problem of the stability of a circular solid plate is also considered. (W.L.H.)

15715 NP-tr-140

ON THE LINEAR DIMENSION OF TOPOLOGICAL VECTOR SPACES. A. N. Kolmogorov. Translated by Morris D. Friedman (Lincoln Lab., MIT) from Doklady Akad. Nauk S.S.S.R. 120, 239-41(1958). 6p.

The linear dimension, δE, is introduced to the case of infinite-dimensional vector spaces; satisfying the conditions: (a) if E is isomorphic to a closed linear subspace of the space E', then $d(E) \leq d(E')$; and (b) if E' is mapped linearly and continuously on E, then $d(E) \leq d(E')$. (D.E.B.)

15716

AN IMPROVED TECHNIQUE FOR FAST MULTIPLICATION ON SERIAL DIGITAL COMPUTERS. M. Shimshoni (Weizmann Inst. of Science, Israel). Electronic Eng. 30, 504-5(1958) Aug.

It is suggested that, in multiplication on serial digital computers, a valuable saving of computing time can be achieved without using parallel multiplier circuits by considering only the significant digits of the multiplier. Types of calculation where this method may be applied with advantage are suggested and an example is given. The position of the binary point in the product of such a multiplication is considered and formulae for finding this position are given. (auth)

15717

EFFECT OF A TRANSVERSE FIELD ON SWITCHING RATES OF MAGNETIC MEMORY CORES. Thomas D. Rossing and Sidney M. Rubens (Remington Rand Univac, St. Paul). J. Appl. Phys. 29, 1245-7(1958) Aug.

A ferromagnetic material having a rectangular hysteresis loop can be magnetized much easier if a magnetic field is applied transverse to the direction of remanence at the same time the remagnetizing pulse is applied. This effect, which has been observed in cores of ferrite, rolled Permalloy and vacuum-deposited alloys, is shown to be compatible with the existing theories of domain wall motion. It forms the basis of an improved method of writing into magnetic memory cores in a digital computer. (auth)

15718

ON FINITE-DIFFERENTIAL DIFFUSION EQUATIONS. G. I. Marchuk. pp. 22-44 in "Fizika i Teplotekhnika Reaktorov." Moscow, Publishing House on Atomic Power, 1958. 213p. (In Russian)

The method of continuous reckoning was used for the derivation of the finite differential diffusion equation. (R.V.J.)

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Refer also to abstract 16072.

15719 BLG-21

Brussels. Centre d'Etude de l'Energie Nucleaire.

TRAITEMENT DES EMULSIONS NUCLEAIRES SANS SUPPORT POUR L'OBTENTION DE DETECTEURS DE DIMENSIONS REDUITES. (Treatment of Nuclear Emulsions without a Support to Obtain Detectors with Reduced Dimensions.) C. Beets, J. Fournaux, and R. Sour. Apr. 15, 1958. 10p.

In order to obtain a precise location of the detector and to reduce the internal perturbations caused by the detection and support materials, nuclear emulsions without support were made with reduced dimensions, 8 mm in diameter and 100 and 200 μ in thickness. Their processing, which has as its object the avoidance of radial expansions and the reduction of primary internal distortions and which can effect the measurement of the track lengths, was studied. (J.S.R.)

15720 CNI-2

Italy. Comitato Nazionale per le Ricerche Nucleari, Milan.

UTILIZZAZIONE DI COPOLIMERI CLORO- ACETO-VINILICI NELLA PREPARAZIONE DI FILM SOTTILI DA USARSI IN CONTATORI 4 PI. (Utilization of Chloroacetovinyl Copolymers in the Preparation of Thin Films to be Used in 4 Pi Counters.) M. Bresesti, F. Girardi, G. Segre, and O. Terracini. Apr. 24, 1958. 12p.

Thin films containing from 87 to 97% vinyl chloride and 3 to 13% vinyl acetate were prepared and tested for use in 4π counters. The preparation, characteristics, surface density, and metallization of the film are described in detail. (J.S.R.)

15721 CNI-3

Italy. Comitato Nazionale per le Ricerche Nucleari, Milan.

RASSEGNA DEI PRINCIPALI METODI DI RIVELAZIONE E DI MISURA DELLE CONTAMINAZIONI RADIO-ATTIVE DEI MEZZI GASSOSI. (Review of the Principal Methods for the Detection and Measurement of Radio-

active Contaminants in Gaseous Media.) A. Malvicini and C. Polvani. [1958]. 28p.

The methods of detection and measurement of radioactive contaminants in air and gases are described. The direct methods examined are measurements using the scintillation chamber for α particles, ion current detection instruments, pulse ionization chamber, and the proportional counter. The indirect methods examined are the analysis of activities obtained by filtration of air, by electrostatic precipitation, by filtration of air through adsorbing materials, differential separation and collection of air dust by impact, and by collection of dust from the flow (fall-out). 28 references. (J.S.R.)

15722 HW-55843

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

INVESTIGATION OF KODAK PERSONNEL MONITORING FILM TYPE 2 FOR POTENTIAL USE AT H.A.P.O. W. V. Baumgartner. Apr. 24, 1958. 17p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

Type 2 film was found to be suitable for personnel monitoring at HAPO. The film response to radiation, using standard darkroom practices is a curvilinear function. The film has a linear temperature gradient of 0.10 ± 0.04 optical density/°F (95% confidence limit) over the temperature range of 66 to 74.2°F for the developer solution, and a linear time gradient of 0.12 ± 0.06 o.d./min (95% confidence limit) for the time interval 2 to 6 minutes in the developer solution. Time, temperature, and radiation dose interact and produce second and third order effects which result in the accelerated development of high calibrated film more than that of low calibrated film. The lowest dose that could be detected by Type 2 film is less than 1 mr of 34.3 kev x radiation or 15 mr radium gamma radiation using standard darkroom developing practices. X and gamma radiation with energies less than radium gamma darken the film more per unit dose with a maximum darkening being observed around 34 kev. A unit dose of uranium beta darkened the film about two-thirds as much as a unit dose of radium gamma. Using concentrated Farmers Reducer Solution to bleach the image on the sensitive side of the film, it is possible to measure more than 500 r of radium gamma radiation using standard darkroom practices and HAPO type densitometers. The film exposed to radiation three months before developing had about 12% increase in density over the film exposed to radiation the day before developing. The increase in density seems to be a linear function. (auth)

15723 NP-6900

Joint Inst. for Nuclear Research, Moscow. Lab. of High Energy.

24-LITRE PROPANE BUBBLE CHAMBER. Wang Kanchang, M. I. Soloviev, and Yu. N. Shkobin. 1958. 13p.

A 24-liter propane bubble chamber with 55 × 28 × 14 cm^3 volume is described. The chamber operates in a steady magnetic field. Water separated from the propane by sylfon bellows is used to transfer the pressure. The expansion system with the electromagnetic valve is placed outside the main magnetic field. The chamber is illuminated at an angle of 90° to the photographing axis. In order to obtain the black background, a black glass is placed on the bottom of the chamber. (auth)

15724 NYO-8547

Pennsylvania. Univ., Philadelphia.

DETECTION OF FRACTIONAL-MEV NEUTRONS IN PLASTIC SCINTILLATOR. D. Kraus, K. Lande, E. Leboy, and W. Selove. Aug. 25, 1958. 5p. Contract AT(30-1)-2055. $1.80(ph OTS); $1.80(mf OTS).

The light output for proton recoils from fractional Mev neutrons of plastic scintillators was investigated. At neutron energies of ½ to ⅓ Mev, the light output produced by proton recoils is 2 to 2½ times smaller than that from electrons of corresponding energies. The integral pulse-height spectra obtained from a plastic scintillator when exposed to ½ Mev neutrons and gamma rays from Co^{60} source are shown. (W.D.M.)

15725 UCRL-5273-T

California. Univ., Livermore. Radiation Lab.

LABORATORY PRODUCTION OF FINE GRAIN NUCLEAR EMULSION. Albert J. Oliver. July 10, 1958. 28p. Contract W-7405-eng-48. $4.80(ph OTS); $2.70 (mf OTS).

Nuclear emulsions were made in a manner similar to that of Demers and of Perfilov. An attempt was made to achieve the grain size and sensitivity of Perfilov's type P-9 Sensitive emulsion. Silver bromide grain sizes of essentially the same average size as Perfilov's were made from precipitations carried out over a narrow range of pAg's. Three brands of gelatin were tried. High sensitivity has not been achieved. (auth)

15726 USNRDL-TR-236

Naval Radiological Defense Lab., San Francisco.

EXPERIMENTAL STUDY OF THE EFFECT OF FIELD OF VIEW ON TRANSMISSION MEASUREMENTS. M. G. Gibbons. May 16, 1958. 40p. (AFSWP-1078).

The ratio of the amounts of scattered and direct thermal radiation received from a 4π source has been measured for source-receiver distances of 1.18, 4.33, 6.79, 9.81, and 14.37 miles. A large flashlamp surrounded by a frosted globe was used as a source. The receiver consisted of any one of five combinations of Wratten filters and photomultiplier tubes having peak responses at 0.40, 0.50, 0.70, 0.83, and 0.90 micron and feeding into an oscilloscope, the screen of which was photographed. A device for controlling the field of view of the receiver allowed choice of fields of view from 4 to 58.33° half-angle, and an occulter allowed the direct radiation to be blocked out if desired. It has been found that for a given field of view the ratio of scattered to direct radiation received from such a source under no overcast conditions is greater the shorter the wavelength and that for source-receiver distances of up to about 7 miles this ratio is approximately porportional to the optical thickness (path length times attenuation coefficient) of the path. For source-receiver distances greater than 7 miles and a given attenuation coefficient and field of view, the ratio in question has been found to decrease slowly with increasing distance. Fairly complete results are given for the case of no overcast and less complete results are given for the case of full or partial overcast. (auth)

15727 USNRDL-TR-240

Naval Radiological Defense Lab., San Francisco.

RESIDUAL GAMMA RADIATION FIELDS FROM INDUCED SOIL ACTIVITIES. R. L. Mather. Apr. 9, 1958. 31p.

The residual gamma radiation from neutron-induced activities in the soil around ground zero following a nuclear detonation is an important hazard in some situations. Two empirical profiles of activation vs. depth in the soil are assumed and the characteristics of the direct gamma radiation field above the soil are computed. Scattered radiation is estimated to contribute about 86% as much hazard as the direct radiation but is not computed. The characteristics for the induced radiation field are contrasted with the characteristics of a

fallout radiation field and marked differences are found in the angular distribution (more uniform), variation of total intensity with height (less), radius of the importantly contributing area (less), and the radiation protection afforded by a hole (much less). (auth)

15728 USNRDL-TR-246

Naval Radiological Defense Lab. San Francisco. COMPLEMENT-SUBTRACTION METHOD FOR DIRECT ESTIMATION OF GAMMA-RAY ABUNDANCES IN RADIONUCLIDE MIXTURES. W. Lee. July 10, 1958. 26p.

A simple, direct technique is presented for the quantitative estimation of gamma-emitting radionuclides in mixtures by means of scintillation spectroscopy. The method described makes use of a rather unique feature of the Argonne type 256-channel analyzer which permits subtraction of a gamma-ray scintillation spectrum from previously accumulated data. The method requires a special dead-time correcting device and an individual calibrated standard of each radionuclide which is to be determined. The amount of activity is estimated from a direct comparison of counting rates, thus eliminating all need for mathematical or graphical analysis of data. Since in the present method the standard is always subtracted out as soon as possible after the sample data is taken without any change in the conditions of measurement, there is no requirement for accurately duplicating and maintaining previously established operating conditions other than the initial energy calibration needed for locating and identifying the various peaks in a mixture. The usual variables of counting rate, detector efficiency and voltage gain have very little effect on the over-all precision attainable. The method has been thoroughly tested with unknown four-component mixtures containing varying proportions of Sn^{113}, Cs^{137}, Mn^{54}, and Co^{60}. (auth)

15729 AEC-tr-3276

THE ABSOLUTE EFFICIENCY OF MEASURING WITH A COUNTER TUBE FOR THE ABSOLUTE CALIBRATION OF RADIOACTIVE ISOTOPES AND FOR OTHER QUANTITATIVE INVESTIGATIONS. Manfred Leistner. Translated for Westinghouse Electric Corp. Atomic Power Div. from Z. Physik 141, 463-75(1955). 15p.

A simple presentation of the absolute efficiency of measuring with a counter tube is given, and an equation is derived for the necessary efficiency of a counter tube. The possibility of an experimental determination is investigated, using a 4π counter tube. (W.D.M.)

15730 NP-tr-146

METHODS OF MEASURING THE ARTIFICIAL RADIOACTIVITY IN THE ATMOSPHERE. G. Schumann. Translated by K. J. Bobin (U.K.A.E.A. Atomic Energy Research Establishment) from Beitr. Physik Atmosphäar 30, 189-99(1958). 14p. (Figures omitted).

Procedures are outlined for measuring small amounts of radioactivity in the atmosphere. The efficiency of various types of filter papers and particle collectors for the collection of air samples is discussed. Counting methods for the examination of filter samples are described briefly. (C.H.)

15731 NP-tr-151

A RAPID METHOD OF EXAMINATION OF NUCLEAR PHOTOEMULSIONS. V. A. Petukhov. Translated for U.K.A.E.A., Atomic Energy Research Establishment. 11p. (Figures omitted).

A method is described for simultaneously observing on a television screen the magnified image of 1 mm^2 of developed nuclear emulsion up to 400 μ thick irrespective of orientation or depth of the tracks. Only random conglomerations of background grains are projected with the tracks, reducing the background ~1,000 times. Scanning speeds of 10 cm^2/hour can be achieved with conventional optical systems and cathode ray tubes. The method is based on replacing the microscope ocular by a photomultiplier and its associated electronic equipment. (T.R.H.)

15732

TRANSISTOR COUNT-RATE SYSTEMS. L. E. Weisner (E. I. du Pont de Nemours & Co., Inc., Aiken, S. C.). Elec. Eng. 77, 623-5(1958) July.

The use of transistors in nuclear counting systems is discussed, pointing out that their use results in increased reliability, reduced space and power requirements, and lower initial cost. All transistor systems were built for use with BF_3 counters, Geiger counters, and scintillation probes. (J.R.D.)

15733

RADIATION MONITORING OVER LONG-DISTANCE TELEPHONE LINES AND DIRECT FIELD LINES. L. Costrell (National Bureau of Standards, Washington). IRE Trans. Nuclear Sci. NS-5, 21-6(1958) Aug.

Long-distance monitoring of radiation levels can be accomplished economically and reliably over commercial telephone line circuits. The system described was developed for the Atomic Energy Commission for the remote monitoring of gamma radiation resulting from atomic explosions. Though its principal use has been over long distance telephone lines, it can also be used over direct field lines for monitoring sites within approximately 15 miles of the control station. The monitoring stations consume power only during challenges which last for about two minutes each. Total battery drain is therefore quite low, permitting the stations to remain unattended for long periods. (auth)

15734

A DYNAMIC CONDENSER ELECTROMETER SYSTEM FOR BETA PARTICLE DETECTION. S. Fox and R. B. Frank (Nuclear Chicago Corp., Chicago). IRE Trans. Nuclear Sci. NS-5, 27-30(1958) Aug.

An electrometer is described which has been commercially engineered to provide chemists, biologists, and medical technicians with a device for low-level β counting using an ionization chamber. The operation of the instrument and typical applications are outlined. These include C-14 in gas samples, tritium in gas, and the same isotopes in liquid or solid form. (auth)

15735

ELECTRON MULTIPLIER NEUTRON DETECTORS. L. Daum (Westinghouse Electric Corp., Pittsburgh). IRE Trans. Nuclear Sci. NS-5, 30-2(1958) Aug.

A standard photomultiplier tube having uranium coated on the cathode is proposed for use in power reactor control. It will cover the neutron flux range from 10^8 to 10^{11} neutrons/sec/cm^2 or the range from 10^3 to 10^6 neutrons/sec/cm^2. The electron multiplier neutron detector will compete with gamma compensated ionization chambers. Electronic discrimination of both gamma induced pulses and the natural alpha activity of the uranium is used to reduce the gamma sensitivity of the system. (auth)

15736

STUDY OF SOME CONDITIONS OF UTILIZATION OF LIQUID SCINTILLATORS. André Coche and Gilbert

Laustriat (Laboratoire de Chimie Nucléaire, Strasbourg). J. phys. radium 19, 595-601(1958) June. (In French)

An examination was made, in the case of liquid scintillators, of the variation of the proportion of light reaching the cathode of the photomultiplier with the shape and the dimensions of the scintillator and with the nature of the coating which surrounds it. The variation of the pulse height or that of anode current was determined. A certain number of practical indications on the best conditions to be realized for the detection of nuclear radiations can be deduced from those experiments. (auth)

15737

THE PLATEAU SLOPE OF GEIGER COUNTERS WITH ARGON AND ETHYL ALCOHOL. Jacques Franeau, Fernand Grard, and Rene Libert. J. phys. radium 19, Suppl. No. 7, 84A-90A(1958) July. (In French)

The experimental study of the plateau of Geiger counters filled with a mixture of argon and ethyl alcohol has shown that the slope remains practically constant beyond a certain partial pressure of argon. Study of the causes of this slope made clear that at the beginning of the plateau, the cause lies in the differences of the height of the pulses; further on, the secondary pulses become an important cause; however, these are not sufficient to explain the whole slope. (tr-auth)

15738

FLUID DENSITY MEASUREMENT BY GAMMA RADIATION. L. E. Taylor. Nuclear Power 3, 328-9(1958) July.

Applications in industry of fluid density measurements by gamma radiation, where they can be used for the location of liquid-liquid and liquid slurry interfaces, measurement of the specific gravity of liquids, and the density or percent solids of slurries are described. Gamma sources of Cs^{137} and Co^{60} with an ionization chamber detector are discussed. (W.D.M.)

15739

WALK-IN HUMAN COUNTER. Ernest C. Anderson, F. Newton Hayes, and Richard D. Hiebert (Los Alamos Scientific Lab., N. Mex.). Nucleonics 16, No. 8, 106 (1958) Aug.

A new walk-in human counter, built to be displayed at the Geneva Conference, is compared with the Los Alamos human counter. (J.S.R.)

15740

MOCK IODINE FOR I^{131} CALIBRATIONS. Nucleonics 16, No. 8, 134(1958) Aug.

A description is given of mock iodine, a mixture of Ba^{133} and Cs^{137} combined with special absorbers, which is used in the calibration of I^{131}. (J.S.R.)

15741

ON THE CLEARING OF EMULSION PLATES. Y. Prakash, N. Ahamad, and A. P. Sharma (Muslim Univ., Aligarh, India). Nuovo cimento (10) 8, 717-30(1958) June 1.

The effect of the addition of ammonium chloride, ammonium hydroxide, and ammonium sulfocyanide to the Hypo bath of different concentrations, on the clearing time of thin and thick emulsions (up to 1000 μm) was observed. In the case of thin emulsions no rise for higher concentrations was found. A detailed study of the three baths, for different concentrations of ammonium salts was made, and the results indicate an optimum value for a particular temperature and thickness. The effects of the ammonium baths on the developed grain size was also thoroughly studied. The results are discussed on the basis of the prevalent theory. The use of ammonium sulfocyanide is favored in comparison to the other two salts. (auth)

15742

ON THE ENERGY AND PULSE SPECTRA OF A FAST IONIZATION CHAMBER. C. Cernigoi and G. Pauli (Univ. of Trieste and Istituto Nazionale di Fisica Nucleare, Trieste). Nuovo cimento (10) 8, 754-61(1958) June 1.

An analytical investigation is carried out on the influence of geometrical factors of a pulse ionization chamber on the correspondence between energy and pulse spectra. General formulas are given for plane, cylindrical and spherical chambers. The method is suitable to be handled in practical cases and examples are given. (auth)

15743

SEMIAUTOMATIC SCATTERING MEASUREMENTS IN NUCLEAR EMULSIONS. C. Castagnoli, M. Ferro-Luzzi, and M. Muchnik (Univ. of Rome and Istituto Nazionale di Fisica Nucleare, Rome). Nuovo cimento (10) 8, 936-42(1958) June 16.

A simple device is described to semiautomatize scattering measurements and computations, in nuclear emulsion work. Advantages of the system achieved in this laboratory are its low cost and a minimum time gain of 4 or more depending on the type of measurements. (auth)

15744

RESULTS OF INVESTIGATION OF THE DISTRIBUTION OF RADIOACTIVE ISOTOPES BY MEANS OF A NEW GAMMA GRAPHS. Werner Schumacher (Rudolf Virchow-Krankenhaus, Berlin). Strahlentherapie 106, 418-27(1958). (In German)

With the aid of new photogammagrams the possibilities of this method of examination in differential diagnostics and therapy are shown. (auth)

15745

THE RESOLUTION OF THE SCINTILLATION MULTIPLIER AND THE INFLUENCE OF VARYING PARAMETERS ON IT. P. Görlich, A. Krohs, H. J. Pohl, R. Reichel, and L. Schmidt. Z. angew. Phys. 10, 303-9 (1958) July. (In German)

Calculations were made to show that the resolution of a scintillation multiplier could be improved by the proper selection of the parameters which are essential for energy measurements. Linearity measurements, measurements on the proportionality of the photocathodes, and measurements which show the resolution limits of a scintillation counter with respect to the properties of the scintillation crystal are reported. A survey is given of extensively used measuring devices, especially of the single-channel analyzer. (tr-auth)

15746

THE PROPERTIES OF PHOTOGRAPHIC EMULSIONS IN ELECTRON IRRADIATION. H. Frieser and E. Klein (Wiss. Photog. Labor der Agfa AG, Leverkusen, Germany). Z. angew. Phys. 10, 337-46(1958) July. (In German)

The different behavior of photographic emulsions after light and electron irradiation was summarized. The following properties in electron irradiation were then discussed: the density curve, the practical range, the sensitivity, the granularity, and the diffusion halo.

The results were compared with measurements from the literature and automeasurements. In general, the agreement with theory is good. On the basis of the results from this investigation it is possible to derive the optimum conditions for photographic materials for electron irradiation. (tr-auth)

15747

THE STATISTICS OF ELECTRON AVALANCHES IN PROPORTIONAL COUNTER TUBES. IV.
H. Schlumbohm (Universität, Hamburg). Z. Physik 152, 49-58(1958). (In German)

Investigations on the statistics of gas amplification of electron avalanches in radial-symmetric fields (proportional counter with positive wire) are reported. The investigations confirmed, in general, the normal law of carrier distribution. They show, however, under definite research conditions (pressure of the filling gas, wire diameter, and voltage) deviations from the homogeneous field. If at the beginning the carrier propagation $E/\alpha : U_i$ already has a low value, then the smaller avalanches, compared with the normal distribution, appear with less frequency. ($E/\alpha : U_i$ is the quotient of the energy which an electron absorbs from the field E at an average path $1/\alpha$ between two ionized bodies and the minimum ionization of the gas when α is the Townsend ionization coefficient and U_i is the ionization voltage.) Under almost all research conditions practiced with proportional counters, these modifications of the normal distribution were found. In gases with very low electron multiplication (methylal, for example) a lower scattering width than in the normal distribution appears on account of the decrease of the carrier propagation by space charge at high gas amplification ($\bar{n} > 10^6$) which can lead to a definite maximum in the frequency distribution. If the avalanche is accompanied by successors (liberated by γ effect), a much greater pulse is obtained in the pulse spectrum as soon as an avalanche chain is registered as a single pulse on account of the too low resolution of the apparatus. Observations coincide with a measurement made in argon–methane mixtures by Curran et al. (Phil. Mag. 40, 929(1949)). The present investigations show, however, that the dervivation of the distribution function analytically proposed by Curran has no general validity since it is dependent on the special values on $E/\alpha : U_i$ of the counter discharge. (tr-auth)

15748

ON THE ENERGY RESOLUTION OF SCINTILLATION COUNTERS. II. A. M. Ratner and L. S. Kukushkin. Zhur. Tekh. Fiz. 28, 1121-5(1958) May. (In Russian)

Effects of Compton scattering of γ quanta in crystals were studied. The Monte-Carlo method was used in calculations of Cs^{137} γ quanta collimated along the axis of crystals with r = 2 cm, h = 6 cm, r = h = 3 cm, and r = h = 1.5 cm. (R.V.J.)

Mesons

15749 NP-6906

Joint Inst. for Nuclear Research, Moscow. Lab. of Nuclear Problems.

MEASUREMENTS OF NEGATIVE μ–MESONS POLARIZATION IN MESIC ATOMS OF CARBON, OXYGEN, MAGNESIUM, SULFUR, ZINC, CADMIUM AND LEAD. A. E. Ignatenko, L. B. Egorov, B. Khalupa, and D. Chultem. 1958. 14p.

The angular distributions of electrons from μ^- meson decay in mesic atoms of C, O, Mg, S, Zn, Cd, and Pb were measured by means of scintillation counters. The μ^- meson polarization was determined on the basis of measurements. In mesic atoms of Mg, Zn, Cd, and Pb polarization equals to (19 ± 7) %; for C, O, and S mesic atoms polarization equals (14 ± 4) %. The μ^- meson depolarization in matter with zero nuclear spins is explained mainly by spin-orbital interaction in the process of mesic atom production; depolarization is partially connected also with interaction of the magnetic field of the electron atom shell on μ^- meson during its life time on K orbit. (auth)

15750 NP-6907

Joint Inst. for Nuclear Research, Moscow. Lab. of Nuclear Problems.

INVESTIGATION OF μ^--MESON DEPOLARIZATION IN LIQUID HYDROGEN. A. E. Ignatenko, L. B. Egorov, B. Khalupa, and D. Chultem. 1958. 15p.

Angular distribution of electrons from μ^- meson decay in liquid hydrogen measured by a scintillation counter method was found to be isotropic within experimental error. Polarization of μ^- mesons in mesic hydrogen determined from the results of an electron angular distribution was found to be (2.9 ± 2.9)%. The total depolarization of μ^- mesons observed is mainly connected with a mechanism of jumping of a muon from one proton to another with simultaneous transition into the lower state of the hyperfine structure. Due to this mechanism the transformation of orthohydrogen and parahydrogen molecules into each other is possible. (auth)

15751 UCRL-8354

California. Univ., Berkeley. Radiation Lab.

ANGULAR DISTRIBUTION OF PHOTOPIONS FROM HYDROGEN (thesis). Edward A. Knapp. July 1, 1958. 60p. Contract W-7405-eng-48. $1.75(OTS).

An accurate measurement of the differential cross section for the photoproduction of positive pions was made at the Berkeley synchrotron, for photon energies of 260 and 290 Mev. The mesons were produced in a thin-walled liquid hydrogen target, and the meson detection apparatus utilized the characteristic $\pi-\mu$ decay of the meson. The measurements were done in two steps, from 0 to 50° with equipment specifically designed to reduce a very high positron background, and from 30 to 160° with equipment whose efficiency and solid angle could be accurately determined. The experimental results in the small-angle region definitely show the effects of "photoelectric" production of pions from the cloud surrounding the nucleon, which are characterized by an abrupt flattening of the cross section in the region forward of 40° (c. m.). The results are compared to the theory of photoproduction derived from the dispersion relations, and the agreement is satisfactory within the limitations of the theory. (auth)

15752

PION-PION INTERACTION AND MULTIPLE PION PRODUCTION IN NUCLEON-ANTINUCLEON ANNIHILATION PROCESS. T. Goto (Nihon Univ., Tokyo). Nuovo cimento (10) 8, 625-31(1958) June 1.

The multiple pion production in antinucleon-nucleon annihilation processes is investigated by means of the statistical theory with the strong pion-pion interaction. The characteristics of the isobar state of two pions are determined from the observed momentum distribution of a nucleon in the reaction $\pi^- + p \rightarrow N + 2\pi$ at 1 Bev or from the theories of Takeda, Dyson, and Miyazawa. The

mean number of produced pions is 3 + 4 and rather less than that given by experiment. (auth)

15753

ABSORPTION OF SLOW NEGATIVE KAONS IN HYDROGEN AND DEUTERIUM. A. Fujii and R. E. Marshak (Univ. of Rochester, N. Y.). Nuovo cimento (10) 8, 643-62(1958) June 1.

The transition probabilities for the competing reactions resulting from the absorption of slow negative kaons in hydrogen and deuterium were calculated on the basis of a simple model. Computations were carried out for scalar and pseudoscalar coupling of the kaon from the 1s and 2p orbitals of the appropriate K-mesic atom. The absorption from the 2p state in enhanced with respect to the pion case because of the smaller size of the orbit. This effect tends to reduce the possibility of distinguishing between the scalar and pseudoscalar character of the kaon coupling in strong interactions. The emission of a single pion is favored for deuterium as well as for hydrogen. Qualitative conclusions are drawn concerning the relative importance of the other modes of kaon absorption in both hydrogen and deuterium. (auth)

15754

INTERACTIONS AND DECAYS OF K^- MESONS. II. ANALYSIS OF THE DECAYS. Y. Eisenberg, W. Koch, E. Lohrmann, M. Nikolic, M. Schneeberger, and H. Winzeler (Univ. of Bern). Nuovo cimento (10) 8, 663-70(1958) June 1.

In a systematic study of about 1600 K^--mesons in nuclear emulsions, 2 τ^- and 50 events where the primary K^- disappears in flight, giving rise to nothing but one "light track," were observed. 12 of these events had an associated blob at the K^- disappearance point and 38 had no such blob. It is shown that most of the 38 events without an associated blob are examples of K^- decay in flight. Detailed analysis of these events gives the following results: a) The $K^-_{\mu 2}$ and the $K^-_{\pi 2}$ decay modes should be considered as established. The mean C.M.S. kinetic energies of the secondaries observed were: $K_{\mu 2}$; T_μ^{CM} = (153 ± 4) Mev, $K_{\pi 2}$; T_π^{CM} = (109.5 ± 3) Mev. b) The relative abundance of the $K_{\mu 2}$ is about 50%. c) The mean K^- lifetime is $\tau_{K^-} = (1.60 \pm 0.3) \cdot 10^{-8}$ s. (auth)

15755

SOME EXPERIMENTAL RESULTS ON THE ANGULAR CORRELATIONS IN THE π-μ-e DECAY. J. K. Boggild, K. H. Hansen, and M. Scharff (Univ. of Copenhagen). Nuovo cimento (10) 8, 767-9(1958) June 1.

The π-μ-e decay was studied in a stack of photographic emulsions exposed to cosmic radiation. Part of this stack had earlier been scanned for mesonic events. The decays observed, 796, fulfilled the requirements that the μ-meson stop more than 15 μm from the surfaces of the emulsion. In 29 of these, no positron track was seen. In the remaining 767 decays, the angle θ between the μ-meson track at the π-μ decay point and the positron track at the μ-e decay point was measured. The distribution of θ is graphically shown. The data were checked for systematic errors. The distribution of dip angles for the μ mesons and positrons was examined, and nothing unexpected was observed. The possibility of an observational correlation between θ and the steepness or depth of the tracks was also examined, but no indication of such an effect could be detected. (C.H.)

15756

A SUGGESTION ON THE THEORY OF THE $\pi \rightarrow e + \nu$ TO $\pi \rightarrow \mu + \nu$ RATIO. R. Gatto and M. A. Ruderman (Univ. of Rome and Istituto Nazionale di Fisica Nucleare, Rome). Nuovo cimento (10) 8, 775-7(1958) June 1.

The main difficulty of proposed theories of universal Fermi interactions is the explanation of the relative rates for $\pi \rightarrow \mu + \nu$ and $\pi \rightarrow e + \nu$. Several experimenters have suggested a theory of weak interactions which leads to a coupling A ± V. This theory seems capable of explaining most of the experimental results on weak interactions. Other possible experimental tests of the hypothesis of a universal Fermi interaction in the A ± V theory have been proposed, but no sufficient data are available at present. (A.C.)

15757

RENORMALIZATION OF AXIAL VECTOR COUPLING. II. J. C. Polkinghorne (Univ. of Edinburgh). Nuovo cimento (10) 8, 781(1958) June 1.

In a previous note (Nuovo cimento 8, 179 (1958)) two axial vector currents were constructed, one for pseudoscalar and one for pseudovector pion-baryon interactions. Both constructuons assumed zero masses for the bare mesons and no meson-meson interactions. The relaxation of these assumptions are discussed. (D.E.B.)

15758

GREEN'S FUNCTIONS IN MESON THEORIES. A. A. Abrikosov, A. D. Galanin, B. L. Joffe, I. Ya. Pomerancuk, and I. M. Halatnikov (Academy of Sciences of USSR, Moscow). Nuovo cimento (10) 8, 782(1958) June 1.

In some recent papers Hiida states that results obtained for the asymptotic Green's functions and vertex part do not agree with calculations based on perturbation theory. In this investigation, mathematical errors are pointed out and the conclusion is reached that Hiida is wrong. (A.C.)

15759

ELECTROMAGNETIC PROPERTIES OF π-MESON. L. Bertocchi and A. Minguzzi (Univ. of Bologna and Istituto Nazionale di Fisica Nucleare, Bologna). Nuovo cimento (10) 8, 783-6(1958) June 1.

By supposing that charged pions are reciprocal charge conjugate spinless particles and assuming gauge invariance, from the validity of the CPT theorem it can be stated that the form factors of π^+ and π^- are equal. (D.E.B.)

15760

A FURTHER EXAMPLE OF AN ANOMALOUS K^+-DECAY. D. J. Prowse (Univ. of California, Los Angeles) and D. Evans (Univ. of Bristol, Eng.). Nuovo cimento (10) 8, 856-60(1958) June 16.

In a systematic study of K^+ meson secondaries, one example has been found in which the charged product is a π meson of 61.7 Mev. This must be compared with the example published by the Columbia group in which the π-meson energy was 60 Mev. Both are probably due to the decay mode: $K^+ \rightarrow \pi^+ + \pi^0 + \gamma$ although the possibility that they belong to a two body decay mode: $K^+ \rightarrow \pi^+ + X^0$, where X^0 is a neutral boson and has a mass of (500 ± 5) m_e, should not be overlooked. A description of the event is given and the interpretation discussed. (auth)

15761

VIRTUAL PION EFFECTS IN μ-MESON CAPTURE. L. Wolfenstein (CERN, Geneva). Nuovo cimento (10) 8, 882-7(1958) June 16.

The μ-meson capture process contains an effective pseudoscalar interaction not present in the corresponding electron processes due to the decay of a single virtual pion emitted by the nucleon. The effect of this interaction on various possible observations is calculated for μ-meson capture in hydrogen and shown to be as large as 25%. (auth)

15762

PROPERTIES OF NEGATIVE K-MESONS. F. H. Webb, E. L. Iloff, F. H. Featherston, W. W. Chupp, G. Goldhaber (Univ. of California, Berkeley). Nuovo cimento (10) 8, 899-921(1958) June 16.

An analysis of interactions of 420-Mev/c K^- mesons incident on a nuclear emulsion stack has been carried out. By following K^- mesons along the track, information was obtained on the interaction of K^- mesons in flight and at rest. The differential scattering cross section was fitted with diffraction scattering off a black disk with radius 1.32 $A^{1/3}$ in agreement with the total reaction cross section. A compilation of K^--H elastic scattering and absorption events is presented, giving cross sections of σ_{KH}(scattering) = (48.4^{+15}_{-11}) mb and σ_{KH}(absorption) = (11.4^{+9}_{-5}) mb. The inelastic scattering of K^- mesons in complex nuclei has been found to be only 4% of the absorption cross section. The average energy losses in K^- inelastic scattering events is ~50% of the incident K energy, in contrast to a 25% loss for K^+ inelastic scattering. In the course of this work a number of decays were observed in flight. Combining these with earlier data, a mean life of $\tau_{K^-} = (1.3^{+0.4}_{-0.3}) \times 10^{-8}$ s was obtained. Some of the secondaries from decays in flight were identified, namely, 2 $K_{\pi 2}$, 2 $K_{\mu 2}$, and 1 K_{e3}. From K^--H absorption events a $\Sigma^- - \Sigma^+$ mass difference of (13.9 ± 1.8) m_e and a value of the K^- mass of (966.7 ± 2.0) m_e were obtained. From an analysis of the charged pion spectrum obtained from K^- interactions at rest, it was possible to calculate the ratio of Λ to Σ hyperons produced in the primary interaction. In the primary K^- nucleon absorption reaction, Σ-hyperon formation dominates over Λ-hyperon formation. An energy and strangeness balance shows that 70% of the K^- stars at rest emit a Λ particle. This means that about 60% of the Σ hyperons that are produced are converted to Λ-hyperons inside the nucleus in which they were formed. (auth)

15763

THE SELECTION RULES ON THE HYPERON DECAYS. K. Nakagawa and H. Umezawa (Univ. of Tokyo). Nuovo cimento (10) 8, 945-8(1958) June 16.

A study was made of the selection rules in the Σ^+ decay processes. A branching ratio of ≈1 and a mean life ratio of ≈½ were assumed. (W.D.M.)

15764

SCATTERING OF μ^- MESONS BY NUCLEI. J. Franklin, B. Margolis, and H. Oberthal (Columbia Univ., New York). Phys. Rev. 111, 296-7(1958) July 1.

Previous hand calculations for the scattering of μ^- mesons by nuclei have been extended by using a IBM-650 Computer to include energies corresponding to v/c = 0.2 (E = 2.1 Mev) and 0.4 (E = 9.6 Mev) for the nuclei Z = 48 and 80, the nucleus being considered as a uniformly charged sphere of radius R = $1.2A^{1/3} \times 10^{-13}$ cm. (auth)

15765

DISPERSION THEORY TREATMENT OF PION PRODUCTION IN ELECTRON-NUCLEON COLLISIONS. S. Fubini and Y. Nambu (Univ. of Chicago) and V. Wataghin (Univ. of Wisconsin, Madison). Phys. Rev. 111, 329-36(1958) July 1.

The production of mesons in electron-nucleon collisions is treated by using the method of dispersion relations. The result is analogous to that obtained by Chew, Low, Goldberger, and Nambu for photoproduction using the same method. Apart from the appearance of longitudinal and scalar components of the virtual photon polarization, the important difference is that charge and magnetic moments have to be multiplied by the appropriate nucleon electromagnetic form factors. Two formulas are given for the scattering amplitude: one is a static approximation which is valid if the electron invariant momentum transfer λ is less than 500 Mev; the other takes account of the recoil effects, and may be trusted within 30% even up to $\lambda \sim 1$ Bev. It is suggested that the measurement of the energy and angular distribution of the electron can offer an alternative method for the determination of the nucleon form factors. (auth)

15766

PION DECAY AND POSSIBLE NONLOCAL EFFECTS IN THE THEORY OF FERMI INTERACTIONS. A. Sirlin (Columbia Univ., New York). Phys. Rev. 111, 337-42(1958) July 1.

Possible nonlocal effects in the theory of Fermi interactions are studied phenomenologically. Under certain simple assumptions, an effective Hamiltonian is derived which reduces to the local V−A interaction in the limit in which the momentum transfer between the two pairs of Fermi particles is very small. For larger values of the momentum transfer, corrective terms appear which may account phenomenologically for the deviations of the ρ value and the ratio R = $(\pi \to e + \nu)/(\pi \to \mu + \nu)$ from the predictions of the local V−A theory. The pion and muon decays are analyzed in detail. Other weak processes are briefly discussed. (auth)

15767

PHOTOPRODUCTION OF SINGLE POSITIVE PIONS FROM HYDROGEN IN THE 500-1000 Mev REGION. F. P. Dixon and R. L. Walker (California Inst. of Tech., Pasadena). Phys. Rev. Letters 1, 142-4(1958) Aug. 15.

A wedge-type magnetic spectrometer was used to analyze positive pions from the reaction $\gamma + p \to \pi^+ + n$ produced in a liquid hydrogen target by the bremsstrahlung beam of a synchrotron. The differential cross sections for various photon energies and center of mass angles were measured. (W.D.M.)

15768

ELECTRIC DIPOLE MOMENT OF THE MUON. D. Berley, R. L. Garwin, G. Gidal, and L. M. Lederman (Columbia Univ., New York). Phys. Rev. Letters 1, 144-6(1958) Aug. 15.

A search for an electric dipole moment in the muon with a sensitivity of the order of 1% of a natural moment, e times the muon Compton wavelength (1.85×10^{-13} cm), is described. (W.D.M.)

15769

π^- SCATTERING AND DISPERSION RELATIONS. H-Y. Chiu (Cornell Univ., Ithaca, N. Y.) and J. Hamilton (Cornell Univ., Ithaca, N. Y. and Brookhaven National Lab., Upton, N. Y.). Phys. Rev. Letters 1, 146-7(1958) Aug. 15.

Work is reported which weakens the evidence for disagreement between the experimental and theoretical values of the π^--p dispersion relations. The elastic differential cross sections at 150, 170, and 220 Mev were reexamined to determine the effect of a d-wave

fit of the form A + B cos θ + C cos$^2\theta$ + D cos$^3\theta$. (W.D.M.)

15770

Λ^0, θ_1^0, θ_2^0, AND $\overline{\theta^0}$ LIFETIMES. Elihu Boldt, David O. Caldwell, and Yash Pal (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. Letters 1, 148-50(1958) Aug. 15.

The lifetimes of Λ^0, θ_1^0, θ_2^0, and $\overline{\theta^0}$ were measured using the large M.I.T. multiplate cloud chamber at the Brookhaven cosmotron. Because of the size of the chamber it was possible to require that the particles have a potential time in the chamber greater than three times the approximate life. This requirement reduced the systematic errors considerably. (W.D.M.)

15771

$\theta_1^0 - \theta_2^0$ MASS DIFFERENCE. Elihu Boldt, David O. Caldwell, and Yash Pal (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. Letters 1, 150-2(1958) Aug. 15.

During an investigation of the properties of heavy unstable particles produced by π^- mesons of 1.5-Bev median energy in the iron plates of a large multiplate cloud chamber, twelve cases of hyperon production by neutral particles were observed. These were interpreted as the $\overline{\theta^0} + n \rightarrow Y + \pi$ reaction. (W.D.M.)

15772

DISPERSION RELATION FOR THE PHOTOPRODUCTION OF K-MESONS. Susumu Okubo (Univ. of Rochester, N. Y.). Progr. Theoret. Phys. (Kyoto) 19, 43-56 (1958) Jan.

Dispersion relations for the photoproduction of K mesons by nucleons are derived both covariantly and non-covariantly. They contain the renormalized Born term with inclusion of the magnetic moments of baryons. (auth)

15773

ON THE DECAY INTERACTIONS OF STRANGE PARTICLES. Yoshihiko Miyachi (Hiroshima Univ.). Progr. Theoret. Phys. (Kyoto) 19, 112-24(1958) Jan.

Under the assumption that the Konopinski-Uhlenbeck interaction works as an origin of weak interactions in which the existence of strange particles should be taken into account, the decay events $K_{\mu 3}^{\pm}$, $K_{e3}^{\pm}$, $K_{\mu 3}^0$, and K_{e3}^0 are investigated. The available data seem to be favorable to our predictions, though it is premature to draw any definite conclusions. Some remarks are also made about the β decay of hyperons and the K-meson decay into two leptons. (auth)

15774

INVARIANTS IN $K_{\mu 3}$ AND K_{e3} DECAYS. R. Gatto (Univ. of California, Berkeley). Progr. Theoret. Phys. (Kyoto) 19, 146-52(1958) Feb.

A discussion is given of the $K_{\mu 3}$ and K_{e3} decay modes, making use of the invariance properties of the theory under the general hypothesis of parity nonconservation and lepton nonconservation. The assumption of local interaction between the final fermions is examined in detail. Detection of a possible updown asymmetry, with respect to the $K_{\mu 3}$ decay plane, of the electrons from the subsequent μ decay is suggested as a possible test of time reversal. (auth)

15775

MULTIPLE MESON PRODUCTION IN ANTINUCLEON-NUCLEON ANNIHILATION. Nobuo Yajima and Keizo Kobayakawa (Osaka Univ.). Progr. Theoret. Phys. (Kyoto) 19, 192-200(1958) Feb.

The multiple meson production in the antinucleon-nucleon annihilation is studied. Assuming that the whole system establishes a statistical equilibrium, the temperature of the system is adopted as the only parameter, and deciding the critical temperature in similar way as Landau's numerical values are obtained which agree with experimental data, and the question of why one must take a large magnitude of the interaction volume as a parameter in the Fermi statistical model is cleared up. (auth)

15776

ELASTIC NUCLEAR SCATTERING OF POSITIVE K MESONS AT LOW ENERGIES. N. Schmitz (Max-Planck-Institut für Physik, Göttingen, Germany). Z. Naturforsch. 13a, 507-10(1958) July. (In German)

The differential cross section for elastic K^+ meson-nucleus scattering at low energies (20 to 60 Mev) is calculated according to the optical model for a square well potential which permits an exact solution of the Schrödinger equation inside and outside the nucleus. The calculated curves are compared with experimental data which were obtained from measurements in nuclear emulsions. From this comparison it seems to be obvious that the nuclear force acting upon a K^+ meson is repulsive also at low energies and that the corresponding nuclear potential is rather energy independent with a value of about 15 Mev. (auth)

Meteorology

15777 SCR-47

Sandia Corp., Albuquerque, N. Mex.

THE USE OF METEOROLOGICAL DATA BY SANDIA CORPORATION. H. J. Plagge. Sept. 1958. 16p. Contract AT(29-1)-789. $3.30(ph OTS); $2.40(mf OTS).

Presented at Second National Conference on Applied Meteorology: Engineering, Ann Arbor, Mich., Sept. 9-11, 1958.

Meteorological instruments used for the collection of upper air data and surface observations are listed. The meteorological data furnished for weapons tests include pressure, temperature, density, and data on speed of sound and wind versus altitude. Methods used in obtaining the data are described. (C.H.)

Microwaves

15778 UCRL-4836(Rev.)

California. Univ., Livermore. Radiation Lab.

MICROWAVE DIAGNOSTICS FOR CONTROLLED FUSION RESEARCH. Charles B. Wharton. Sept. 1957. 34p. Contract W-7405-eng-48. $1.00(OTS).

The properties of a plasma of arbitrary geometry measurable by microwave techniques are: average spatial density, density distribution, collision frequency, electron "kinetic temperature," and recombination and other loss rates, all as a function of time, with or without strong magnetic fields present. The quantities measured directly are the phase and absorption coefficients of the dispersive propagation "constant," the electron and ion gyrofrequencies, intensities of electromagnetic radiations emanating from the plasma, and emission spectra of these radiations. A brief theoretical discussion of the mechanisms involved and experimental results indicating satisfactory correlation are presented. Experimental setups and millimeter wave-length equipment employed in the experiments are described. (auth)

15779

ON THE AXIAL PHASE ANOMALY FOR MICROWAVE LENSES. G. W. Farnell (McGill Univ., Montreal). J. Opt. Soc. Am. 48, 643-7(1958) Sept.

The behavior of the phase along the axis of aberration-free microwave lenses is shown by curves of the axial phase anomaly calculated from scalar Kirchhoff diffraction theory. These curves are drawn for three different wavelengths and two typical focal lengths. Also illustrated in the calculated results are the errors introduced by the use of certain geometrical approximations commonly employed in light optics. Detailed experimental measurements have been made of the electric field along the axis in the point-source image produced by solid dielectric lenses at a wavelength of 3.2 cm. Despite the limited size of the exit pupil (radius approximately 8 wavelengths) the agreement between the measured values of the axial phase anomaly and those calculated from scalar theory is very good except within about one lens radius of the lens surface. (auth)

Molecular Properties

15780 AEC-tr-3337

ON THE LIMITATIONS TO THE VALIDITY OF THE COSINE LAW OF MOLECULAR RADIATION. (Über die Gültigkeitsgrenzen des Kosinusgesetzes der Molekularstrahlung.) Herbert Mayer. Translated by K. D. Carlson (Argonne National Lab.) from Z. Physik 58, 373-85(1929). 22p.

The limits to the validity of the cosine law of molecular radiation was investigated with a torsion method described elsewhere. It was found that the cosine law holds for various sized openings in a thin wall (from 0.09 to 0.00006 mm^2) even if the pressure in the space from which the molecules come is increased up to 4.5 mm Hg, assuming that the pressure in the space into which the molecules fly is maintained sufficiently low. On the other hand, when the molecules flow out of space I into space II not through an opening in a very thin wall but through a channel, a strong beam formation occurs for the outflowing molecules. The shape of this beam, as soon as the channel length had attained about three times the length of the diameter, is independent of the length of the channel as well as of the diameter of the channel and the kinds of gases flowing through. The evaluation of the experimentally ascertained impulse functions shows that the molecular density in the direction of the channel axis is between ten to twelve times greater than that for the case of isotropic distribution of the emerging molecules. (auth)

15781

EXCITATION OF MOLECULAR VIBRATION ON COLLISION. Morris Salkoff (New York Univ.) and Ernest Bauer (AVCO, Lawrence, Mass.). J. Chem. Phys. 29, 26-31(1958) July.

The cross section for excitation of the first vibrational level in the collision of two hydrogen molecules in the ground state was calculated. A partial wave analysis is used, and the radical equation is solved for many values of angular momentum using the high speed computer Univac. The major contribution to the total cross section comes from large values of the angular momentum, of the order of 10 to 20, and values of the angular momentum up to about 80 must be considered. In the energy range of interest, 0.5 to 2 ev, the total cross section is obtained, and the vibrational relaxation time is also computed. The value of the cross section is found by calculation to be very sensitive to the precise values of the intermolecular potential used. (auth)

15782

ELECTRONIC STRUCTURE OF LiH. III. THE KNIPP WAVE FUNCTION. Fred T. Ormand and F. A. Matsen (Univ. of Texas, Austin). J. Chem. Phys. 29, 100-2 (1958) July.

The electronic energy and dipole moment of lithium hydride have been computed from a 10-term wave function which used orbitals of the James and Coolidge type (excluding terms containing interelectronic distances) for the valence electrons. The best energy obtained was -217.13^3 ev. The dipole moment was computed to be -5.574D (hydrogen negative), significantly close to the -6.04D obtained previously from a 6 structure valence-bond calculation based on Slater orbitals. (auth)

Neutrons

15783 APEX-408

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

PRELIMINARY REPORT OF AN ANALYTICAL METHOD FOR MEASURING NEUTRON SPECTRA. James B. Trice. Apr. 2, 1957. 12p. (XDC-58-6-134.) $3.30(ph OTS); $2.40(mf OTS).

A method is described for unscrambling foil activation data to derive neutron spectra. (auth)

15784 AEC-tr-3316

THE RESONANCE ESCAPE PROBABILITY IN A LATTICE. (Beräkning av Resonanspassagefaktorn för ett Gitter). B. Pershagen and I. Carlvik. Translated by W. K. Ergen (Oak Ridge National Lab.) from report AEF-71, Aktiebolaget Atomenergi, Stockholm, Feb. 1957. 28p.

A new method for calculating the resonance-escape probability in an infinite rod lattice is given. The method differentiates between resonance capture of neutrons in the rod from which they originated as fast neutrons and capture in rods other than the one in which they were born. The absorption is taken to be proportional to the slowing-down density in the resonance region at the surface of a rod. The factor of proportionality is related to the effective resonance integral, determined by experiment. Different lattice arrangements (square, hexagonal, etc.) can be considered, but the formula has been worked out only for square lattices. A numerical comparison between this method and the classical formula shows that appreciable deviations may occur especially for large lattice distances and large rod radii. The effect on the analysis of exponential experiments is discussed. (auth)

15785

INVESTIGATIONS OF MODERATED NEUTRONS IN GRAPHITE AND IN URANIUM–GRAPHITE HETEROGENEOUS SYSTEM BY THE PULSE METHOD. A. V. Antonov, A. A. Bergman, et al. pp. 82-95 in "Fizika i Teplotekhnika Reaktorov." Moscow, Publishing House on Atomic Power, 1958. 213p. (In Russian)

Investigations of neutron moderation processes in graphite showed that neutron moderation during the first 80 to 90 μsec takes place by elastic collisions with free nuclei. Neutron interactions with the graphite crystalline lattice begins at time t <80 to 90 μsec. It is assumed that the neutron spectra is close to Maxwellian at 160 μsec, which corresponds to the instantaneous temperature of 800 to 900°K. The magnitude of $1/\beta$ = 200 ± 25 μsec. (R.V.J.)

Nuclear Physics

15786 AFOSR-TN-58-386

Paris. Ecole Normale Superieure. Laboratoire de Physique.

ON THE NUCLEON-ANTINUCLEON INTERACTIONS. Technical Note No. 10. M. Gourdin, B. Jancovici, and L. Verlet. [1957]. 17p. Contract AF61(514)-1060. (AD-154293).

The nucleon-antinucleon cross sections at 167 Mev have been computed with two complex potential well models. Yukawa shaped complex wells were first studied in Born approximation. A semi-theoretical potential has then been analyzed on the digital computer IBM 704: the real part is the Signell and Marshak potential, adapted to the nucleon-antinucleon problem, and the imaginary part, a Yukawa phenomenological well. In order to account for the experimental results (large total cross-section and small scattering cross section), it appears necessary to choose a weak real potential and an imaginary potential having a range at least equal to the usual nuclear force range. The fixed source meson theory leads to a real potential, which is much too strong and does not predict an imaginary potential at all; this theory cannot account for the experimental results. (auth)

15787 CU-174

Columbia Univ., New York. Pupin Cyclotron Lab. and Columbia Univ., New York. George B. Pegram Lab.

PROGRESS REPORT FOR JANUARY, FEBRUARY, MARCH 1958 TO THE UNITED STATES ATOMIC ENERGY COMMISSION. 47p. Contract AT-30-1-GEN-72. $7.80(ph OTS); $3.30(mf OTS).

Resonance parameters for U^{238} were determined for levels up to 1000 ev. Γ_n was determined for all of the 54 levels observed, and Γ_γ was determined for 32 of the strongest levels. A scintillation neutron detector using the $B^{10}(n,\alpha)Li^7$ reaction and detecting the 480-kev gamma rays was constructed using four sodium iodide crystals 5 in. in diameter and 1 in. thick. Data are presented on the energy dependence of the U^{235} fission cross section. An $N^{14}(n,p)$ scintillation counter was developed as an energy sensitive neutron detector to determine precisely the (n,p) cross section at particular energies. A proportional counter was developed to measure the angular distribution of neutrons elastically scattered by He^3. A polarization of 20% for neutrons from the $H^2(d,n)He^3$ reaction was measured in the energy range from 2 to 4.5 Mev. The angular distribution of alpha particles from the $N^{15}(d,\alpha)C^{13}$ reaction was investigated with a deuteron energy of 21 Mev. The center of mass differential cross section varies between 20 and 400 mb. The low-lying states in Ne^{20} were excited using the $Ne^{20}(p,p')$ and the $Na^{23}(p,\alpha)$ reactions, and their gamma radiations to lower-lying states observed. The low-lying states in Na^{23} were excited by the $Na^{23}(p,p')$ reaction. A phase shift analysis of the alpha scattering on O^{16} was completed. The neutron capture cross sections of Au^{197} and Ag^{107} were calculated from the statistical theory of nuclear reactions. The calculations on the formation of the compound nucleus U^{236} by the U^{235} + n reaction were corrected by estimating the energy dependence of the radiation widths. (For preceding period see CU-171.) (W.D.M.)

15788 IDO-16436

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

QUARTERLY PROGRESS REPORT FOR MTR-ETR TECHNICAL BRANCHES. Fourth Quarter-1957. G. H. Hanson, ed. Mar. 31, 1958. 63p. Contract AT(10-1)-205. $1.75(OTS).

MTR-ETR Technical Assistance. Since the plutonium material available for a full loading of MTR fuel elements contains an appreciable fraction of Pu^{240}, the resulting decrease in initial reactivity was calculated for nine possible combinations of plutonium contents and Pu^{240} concentrations. Calculations show that a uniform U^{233} loading employing 155-gram fuel assemblies in the 3 × 9 MTR lattice gives the same charge life as a uniform U^{235} loading employing 180-gram fuel assemblies. A complete map of relative thermal neutron flux is reported for an ETR Critical Facility core consisting of 59 fuel assemblies and six withdrawn control rods; the measured excess reactivity with all 16 control rods withdrawn is 9.7%. Two alternate control rod withdrawal programs are possible for ETR operation, and the ETR safety rod shutdown response with both programs was studied. Reactor period measurements show that the worth of the upper portions of the safety rods is significantly greater for the single rod withdrawal program than for the ganged withdrawal. A map of the maximum thermal neutron flux at current ETR operating power of 80 Mw is reported and presents flux information for fuel elements, lattice facilities and the beryllium reflector. MTR-ETR Developments. The new cylindrical MTR shim rod magnet was standardized. Four cylindrical magnets are currently in use and are outstanding in their performance; the remaining three rectangular magnets will be replaced as soon as shutdown and maintenance schedules permit. The reactor transfer function of the MTR 20%-enriched-U loading was measured experimentally; the experimental behavior of the loading is essentially the same as the calculated behavior of the 93%-enriched loading. Detailed experimental statistical weight information for both fuel and poison was developed for the ETR core and its experimental facilities; the variation in statistical weight even within the same reactor region is very marked. The stability of the ETR and its associated heat dissipation system is being studied employing a transfer-function analysis; the reactor core transfer function and the feedback transfer function based on thermal effects and transport delays have been developed. RMF measurements with 33 samples from different heats of ETR fuel core material reveals that the boron content varied from 0.05 to 0.58 weight % and U content varied from 14.8 to 16.3 weight %. Reactor Physics and Engineering. A generalized IBM 650 program was developed for computing the transport approximations (P_1 and P_3) of the local flux distributions in slab geometry; the routine is written to accommodate three-region problems. An application of this program to a fuel assembly problem reveals that the local flux variation predicted by the P_3 approximation is significantly greater than that predicted by the P_1 approximation. Thorium irradiation calculations show that the ultimate U^{233} content is negligibly affected by cycling for periods of the order of an MTR cycle; therefore, thorium is attractive as a monitoring material because the measured change in reactivity is dependent primarily on the accumulated dosage. A concept and engineering design for a Co^{60} Production Reactor were developed. The primary design objective is set by the requirement that the reactor operating at a nominal power of 60 Mw produces at least 100,000 c annually of Co^{60} having a minimum specific activity of 50 c per g. A square reactor core arrangement having a central hole was selected, and Co^{59} control rods are used. The design employs blankets of relatively low cobalt content for the production of high specific activity material and an

outer blanket of high cobalt content to minimize loss of neutrons from the reactor. The estimated annual Co^{60} production is 3,200,000 c of which 330,000 c have a specific activity between 90 and 125 c per g. A literature search on metal-water reactions and the related subjects of reaction kinetics, explosives, and high-temperature chemistry was continued. Nuclear Physics. A large single crystal of magnetite was scanned to determine how it should be cut to make a monochromator suitable for the production of polarized neutrons. In addition to completing the wiring of the 1024-channel analyzer and other improvements into a unified fast chopper system, a 240-counter high efficiency fast chopper detector was added. The automatic sample changer for radioactive samples is in the detailed design stage. Total cross section data for sodium, potassium, strontium, and yttrium were measured. Some preliminary slow neutron measurements with beryllium-filtered neutrons were made with a promising new technique. The sample is attached to a motor-driven rotating arm, and this provides bursts of scattered neutrons with no background of neutrons scattered from the sample between bursts. Time-of-flight measurements were made with an oscilloscope. In the nuclear chemistry program, it was found that the saturated activity Mo^{99}/Ag^{111} ratio (peak-to-trough ratio) was larger by 15 ± 3% for 1.8 ev fission than for thermal fission in U^{233}. The gamma energies and half-lives of Ba^{141}, Ba^{142}, La^{141}, and La^{142} were measured. No Tl^{206} was observed in a mercury sample which had been irradiated with an nvt of 1.1×10^{20} neutrons/cm^2. A value for α_k of 0.16 ± 0.03 was obtained for the K-shell internal conversion coefficient of 15-min Xe^{135m} (isomer). The beta decay of 4.5-hr Sb^{129} was found to be very complex; ten major gamma-rays with energies between 0.18 and 1.73 Mev were identified. (For preceding period see IDO-16430.) (auth)

15789 INSJ-12 (Rpt: UNCLASSIFIED)

Tokyo Univ. Inst. for Nuclear Study.

ON THE RELATIONS BETWEEN THE COLLECTIVE MODEL AND THE SHELL MODEL. A. Arima and S. Yoshida. July 21, 1958. 41p.

The wave function in the collective model is expanded in terms of the shell model wave functions. For the collective model the method of the generating coordinates is employed, and the dilatational mode, the surface vibration mode (one degree of freedom), and the rotational mode (in three dimensional case) are treated. For the first two cases, the ground state wave function in the collective model is mainly composed of the shell model ground state for closed shell nuclei. However, for the rotational case the percentage of the ground state shell model determinant wave function to be found in the rotational state is extremely small for heavy nuclei with a strong deformation. The approximation of Elliott's model is examined and his model was found to give a good approximation to the wave function of light nuclei but not so good for heavy nuclei with strong deformation. Nevertheless, Elliott's model gives the matrix element of the quadrupole transition one half as that given by the collective model if the equilibrium deformation is assumed. (auth)

15790 NP-6905

Joint Inst. for Nuclear Research, Moscow. Lab. of Theoretical Physics.

ON THE MAGNITUDE OF STRANGE PARTICLE PRODUCTION CROSS-SECTION IN NUCLEON-NUCLEON COLLISIONS AT COSMOTRON ENERGY. V. S. Barashenkov and V. M. Maltsev. 1958. 8p.

The probabilities of production of different kinds of particles and their momentum distribution for N-N collision at E = 3 Bev are calculated by statistical theory. The results of calculations are compared with experiment. (auth)

15791

REFORMULATION OF THE THEORY OF THE NUTRINO. S. Kamefuchi (Universitetets Institut for teoretisk Fysik, Copenhagen). Nuclear Phys. 7, 411-20(1958) July (1).

A reformulation of the theory of the neutrino is attempted by generalizing the free Lagrangian so as to include from the outset terms violating parity and particle number conservations. It is shown that, so far as the free field is concerned, our generalized field is equivalent to the usual field and that a difference appears only when interactions are included. An application is also given to the discussion of coupling constant invariants of β-decay. (auth)

15792

A NOTE ON AN ACAUSALITY TEST. I. D. Ito, S. Minami, and H. Tanaka (Tokyo Univ. of Education, Osaka City Univ., Istituto di Fisica dell'Universita, Bologna, and Istituto Nazionale di Fisica Nucleare, Bologna). Nuovo cimento (10) 8, 834-42(1953) June 16.

When the microcausality does not hold, the error of the dispersion relations is shown to be two times the forward scattering amplitude in the acausal region. The order of magnitude of this acausal region is discussed concerning the discrepancy in π^--p scattering found by Puppi and Stanghellini. (auth)

15793

PHOTODISINTEGRATION OF THE DEUTERON IN THE MEDIUM ENERGY RANGE. J. J. de Swart and R. E. Marshak (Univ. of Rochester, N. Y.). Phys. Rev. 111, 272-6(1958) July 1.

The photodisintegration of the deuteron in the medium energy range using the Gartenhaus wave function for the deuteron and the Gartenhaus plus spin-orbit wave functions for the final states has been calculated. The results are in good agreement with experiment. It is shown that the cross sections are sensitive to the triplet odd scattering phase shifts and the D-state probability, but rather insensitive to the detailed shapes of the wave functions. The results indicate that it is not necessary to relinquish Siegert's theorem in order to explain the large isotropic term in the angular distribution in this energy region, provided one assumes a rather high percentage of D state (7%) for the ground state of the deuteron. (auth)

15794

MEASUREMENT OF THE NEUTRON STRENGTH FUNCTION $\overline{\Gamma}_n^0/D$ FOR NUCLIDES WITH 45 TO 75 NUCLEONS. Robert E. Coté, L. M. Bollinger, and James M. LeBlanc (Argonne National Lab., Lemont, Ill.). Phys. Rev. 111, 288-95(1958) July 1.

Neutron transmission measurements have been made on many of the nuclides whose atomic weights lie between 45 and 75. Parameters of individual resonances were deduced for some of these nuclides and for all of them a value of the strength function $\overline{\Gamma}_n^0/D$ was obtained. The experimental values of the strength function indicate a maximum near A = 53. This is consistent with the prediction of the theory of Feshbach, Porter and Weisskopf for a square-well potential with V_0 = 44 Mev, ξ = 0.03 and $R = (1.26A^{1/3} + 0.7) \times 10^{-13}$ cm. The shape of the observed maximum is not in agreement with this simple theory, however, so a discussion is given which

compares the present measurements with predictions based on more realistic models of the nucleus. (auth)

15795

CATALYSIS OF NUCLEAR REACTIONS. S. S. Gershtein (Vavilov Inst. of Nuclear Problems, Moscow). Priroda No. 4, 13-20(1958) Mar. (In Russian)

Catalysis of nuclear reactions is discussed in relation to studies of nuclear processes. (R.V.J.)

15796

TWO-PION-EXCHANGE NUCLEAR POTENTIAL. Michiji Konuma and Hironari Miyazawa (Univ. of Tokyo) and Shochiro Otsuki (Nagoya Univ., Japan). Progr. Theoret. Phys. (Kyoto) 19, 17-30(1958) Jan.

The adiabatic nuclear potential involving the exchange of at most two pions is derived, the self-pimesic field of each nucleon being taken into account. Numerical values of this potential are calculated. The limit of the applicability of this potential is examined, and as a result it is found that this potential can be used in the region of the inter-nucleon distance $x \gtrsim 0.7\ \mu^{-1}$ (μ^{-1}: pion compton wave length). From the analysis of the two-nucleon phenomena, it is found that the quantitative agreement of the theory with experiments is much improved. (auth)

15797

AN ATTEMPT AT REFORMULATING PION-NUCLEON INTERACTION. I. Osamu Hara and Yasunori Fujii (Nihon Univ., Tokyo) and Yoshio Ohnuki (Nagoya Univ., Japan). Progr. Theoret. Phys. (Kyoto) 19, 129-45(1958) Feb.

An attempt is made at reformulating pion-nucleon interactions in such a form that the large annihilation cross section of antiproton or the recent experiments at Stanford could be understood better. For this purpose, a new space (K-space) is introduced. In terms of K-space, charge conjugation can be expressed as a rotation through π around its second axis multiplied by a rotation through π around the second axis in the usual isotopic space. It is shown that if pion-nucleon interaction is assumed as invariant under rotations in K-space (it is already invariant under rotations in the usual isotopic space if we assume charge independence), it can not be local, especially the part responsible for the creation and the annihilation of nucleon pairs. Possibilities of checking this assumption experimentally are discussed, and among these the annihilation of antinucleon by nucleon is discussed in some detail. (auth)

15798

ON PUPPI'S DETERMINATION OF THE PION-NUCLEON COUPLING CONSTANT. K. Matumoto, S. Otsuki, H. Shimodaira, and E. Yamada (Nagoya Univ., Japan). Progr. Theoret. Phys. (Kyoto) 19, 216-17(1958) Feb.

Recently, Puppi and Stanghellini investigated the coupling constant in pion-nucleon interactions. It was found that there is a large difference between the coupling constants which can not be explained through the violation of charge symmetry which comes from electromagnetic effects. If Puppi's results were correct, not only the charge symmetry but also the locality of the interaction Hamiltonian would be violated. The determination of the coupling constant can also be made by analyzing low-energy experimental data in the two-nucleon system. The data from the two-nucleon system may be used to check Puppi's curious result. It cannot be concluded that his result is inconsistent with experimental data on nuclear forces when the experimental error is taken into account. More accurate experiments on n-p scattering and cautious analyses of them are highly desirable. (A.C.)

15799

DISPERSION RELATIONS FOR THE PROCESS $\pi + N \rightarrow \pi' + \pi'' + N'$ IN FIXED NUCLEON APPROXIMATION. W. Zöllner, O. Chrustalow, W. Serebrjakow, and A. Lesnow (Vereinigten Institutes für Kernforschung, Dubna, USSR). Z. Naturforsch. 13a, 499-505(1958) July. (In German)

Dispersion relations for the process $\pi + N \rightarrow \pi' + \pi'' + N'$ in fixed nucleon approximation were derived by means of the Bogoliubov scheme. They show that a considerable part of the non-observable region is covered by a continuous spectrum. An approximate consideration leads to complex integral equations between the hermitic and antihermitic parts of the amplitude. The dispersion relations obtained were used to formulate satisfactory relations of the Chew-Low sort for all symmetry requirements. (tr-auth)

15800

METHOD OF THE SYNTHETIC NUCLEUS IN PROBLEMS OF NEUTRON DIFFUSION IN HYDROGENOUS MEDIA. D. V. Shirkov. pp. 57-61 in "Fizika i Teplotekhnika Reaktorov." Moscow, Publishing House on Atomic Power, 1958. 213p. (In Russian)

A method of synthetic transposition of elastic moderator indicatrix was used to derive the approximation equation for neutron diffusion in hydrogenous media, which in turn was used for direct numerical reckoning of concrete problems. (R.V.J.)

15801

METHOD OF THE SYNTHETIC NUCLEUS IN PROBLEMS OF NEUTRON DIFFUSION IN NON-HYDROGENOUS MODERATORS. D. V. Shirkov. pp. 62-81 in "Fizika i Teplotekhnika Reaktorov." Moscow, Publishing House on Atomic Power, 1958. 213p. (In Russian)

The method of "simplified collision function," based on the approximation transposition of collision function, was used for analytical simplifications of neutron moderation and diffusion spatial-energy problems. (R.V.J.)

15802

NUCLEAR STRUCTURE. Leonard Eisenbud and Eugene P. Wigner. Princeton, N. J., Princeton University Press, 1958. 133p.

Some of the more interesting theoretical approaches to nuclear physics are presented for use in the analysis of large groups of nuclear phenomena. However, neither the mathematical foundations of the points of view described, nor the empirical facts which support them, are developed in full detail. Emphasis is on the description and comparison of the assumptions of various theories, together with a discussion of some of the consequences of these assumptions. Chapters are included on the general features of nuclei, binding energy surfaces in stable nuclei, properties of nuclear states, nuclear reactions, two-nucleon interactions, the uniform nuclear model, the independent particle model, the many particle model, close collision reactions, surface reactions, interaction with electron-neutrino fields, and electromagnetic transitions in complex nuclei. (D.E.B.)

15803

NUCLEAR MOMENTS. H. Kopfermann. English Version Prepared by E. E. Schneider from the Second German Edition, Kernmomente. New York, Academic Press, Inc., 1958. 517p.

The first chapter presents investigations on the hyperfine structure of free atoms by atomic beam methods and optical interference spectroscopy. The second chapter deals with investigations on nuclear moments in free molecules. This comprises the description and interpretation of alternating intensities and magnetic and electrical molecular beam radio-frequency spectroscopy. Also, the essential features of microwave spectroscopy of free molecules, as far as this gives data on nuclear moments, are presented. In the third chapter all radio-frequency methods are discussed which have so far been used for studies of nuclear moments in gases, liquids, and crystals, namely nuclear magnetic resonance, nuclear quadrupole resonance, and paramagnetic resonance. The last chapter deals with the interpretation of the experimental results on nuclear moments in terms of nuclear models, principally the "shell model" which provides the currently most successful description of nuclear structure. (W.L.H.)

Nuclear Properties

15804 ANL-5853

Argonne National Lab., Lemont, Ill.

ON THE PHOTOFISSION CROSS SECTIONS NEAR THRESHOLD OF NUCLEI IN THE REGION OF THE VERY HEAVY ELEMENTS (thesis). Kenneth M. Clarke. July 1958. 91p. Contract W-31-109-eng-38. $2.25(OTS).

Variations in the photofission cross section near "threshold" with initial kind of nucleus were investigated for seven spheroidal nuclei in the region of atomic numbers 90, 92, 93. The photofission cross sections at the two discrete energies 6.14 and 7.0 Mev were determined for the following even-even nuclides: Th^{232}, U^{234}, U^{236}, and U^{238}; and also the odd-A nuclides: U^{233}, U^{235}, and Np^{237}. Nuclear excitation of the target nuclei was achieved via gamma rays from nuclear capture of protons on fluorine. Protons of 1.380- and 3.645-Mev energy impinged on a thick CaF_2 target. The high-energy quanta of 6.14, 6.91, and 7.12 Mev so obtained represent the well-known ground state transitions in O^{16}, whose relative intensities change with bombarding energy of the proton. The fission counting was done in a double-region ionization chamber of 2π geometry. The heavy-element samples were nearly uniform oxide deposits of about one mg/cm^2, on platinum. Employing the known thick target relative gamma-ray intensity ratio, I(6.91 + 7.12)/I(6.14), plus the measured gamma flux and fission counting yield at each of the two above proton energies, the (γ, fission) cross sections at 6.14 and 7.0 Mev were calculated. The (γ, fission) cross sections for Th^{232} and U^{238} are greater at 6.0 Mev than at 7.0 Mev, as indicated by earlier betatron results. U^{236} also exhibits a strong resonance at about 6.0 Mev. However, the other even-even uranium isotope investigated, U^{234}, does not show this behavior. Its (γ, fission) cross section appears to be increasing monotonically with energy between 6.0 and 7.0 Mev. The odd-A uranium isotopes U^{233} and U^{235} also do not show any unusual behavior in this energy interval. The (γ, fission) cross section for U^{234} appears to be essentially constant, which again is a confirmation of earlier betatron studies. For U^{233}, the cross section is increasing with energy. The one odd-proton nuclide examined, Np^{237}, appears also to exhibit a resonance behavior at or about 6.0 Mev. Experimental results are correlated with existing information on low-energy photofission and other nuclear data to explain tentatively the small bumps or resonances in the photofission excitation curves. (auth)

15805 CRRP-787

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

EFFECTIVE CROSS SECTION VALUES FOR WELL-MODERATED THERMAL REACTOR SPECTRA. (1958 Revision). C. H. Westcott. Aug. 1, 1958. 29p. (AECL-670). $1.00(AECL).

Formulas used in the calculations are presented and some of their limitations are discussed. Tables of g- and s- factors and effective cross sections are given for Am^{241}, Am^{243}, Cd, Co, Er, Eu, Gd, Au, Hf, In, Ir, Lu, Mg, Hg, Np^{237}, Pu^{239}, Pu^{240}, Pu^{241}, Pu^{242}, Rh, Sm, Ag, Te, Th^{232}, U^{233}, U^{235}, U^{238}, and Xe^{135}. Graphs of Gd, Au, Pu, U^{235}, and Xe^{135} g-factors, and Gd, Pu, Sm, U^{235}, and Xe^{135} effective cross sections are included. (D.E.H.)

15806 NDA-10-110

Nuclear Development Associates, Inc., White Plains, N. Y.

A GRAPHICAL COMPILATION OF SOME NEUTRON CROSS SECTIONS. Norman R. Adolph, comp. Jan. 12, 1954. 14p. $4.80(ph OTS); $2.70(mf OTS).

The neutron cross section data used by ORNL in multi-group calculations on the UNIVAC are collected in a convenient graphical form. Absorption, transport, and total cross sections are presented as a function of lethargy for Be, B, D, F, Inconel, Li, Ni, Na, 302 stainless steel, and Zr. (L.T.W.)

15807 UCRL-8294

California. Univ., Berkeley. Radiation Lab.

THEORETICAL STUDIES OF THE ALPHA DECAY OF DEFORMED NUCLEI (thesis). Richard R. Chasman. June 1958. 40p. Contract W-7405-eng-48. $1.25(OTS).

The alpha decay of a deformed odd-mass nucleus, U^{233}, is treated by the use of numerical integration on an IBM-650 computer. The results of this treatment are compared with the theory of Bohr, Fröman, and Mottelson. Approximate analytic methods are developed for calculating the amplitudes of alpha partial waves at the surface of deformed even-even nuclei. A two-term expansion modifying the ordinary Coulomb function to account for nuclear quadrupole coupling is applied. The amplitudes of alpha partial waves at the nuclear surface are tabulated for eight choices of phase and three values of the intrinsic nuclear quadrupole moment. The analytic method is developed to predict the intensities of the higher members of the ground rotational band. A comparison is made between the numerical integration and the experiments of Roberts, Dabbs, and Parker, in which they examine the angular distribution of alpha particles from aligned U^{233} nuclei. A detailed comparison is made between the analytic treatment developed here, that of Fröman, and the numerical integration of Rasmussen and Hansen for Cm^{242}. The results of the numerical integration of U^{233} are presented in matrices analogous to those of Fröman. (auth)

15808

A MODIFIED SECOND ORDER PERTURBATION THEORY. Jerome I. Kaplan (Weizmann Inst. of Science, Rehovot). Bull. Research Council Israel Sect. F 7F, 31-2(1957) Dec.

A second-order correction is shown which allows energy to be calculated using only the zero-order ground state function where ΔE is fixed by a variational calculation. (A.C.)

15809

THE THERMAL NEUTRON CAPTURE CROSS SECTION AND THE RESONANCE ABSORPTION INTEGRAL OF Th^{230} (IONIUM). M. J. Cabell (Atomic Energy of

Canada, Ltd., Chalk River, Ont.). Can. J. Phys. 36, 989-96(1958) Aug.

The thermal neutron capture cross section and the resonance capture integral of Th^{230} have been determined by an activation method. Assumptions are made that the thermal capture cross section and the resonance capture integral of Co^{59} are 36.5 barns and 48.6 barns, respectively, that the half life of Th^{230} is 8.00×10^4 years, and that Th^{230} behaves as a 1/v absorber in the subcadmium region. Based on these assumptions values of $\sigma_{2200} = 21.4 \pm 0.3$ barns and of 937 ± 32 barns for the resonance absorption integral (from 0.5 ev to ∞) have been obtained for Th^{230}. The half life of Th^{231} has been determined as 25.52 ± 0.01 hours. (auth)

15810

NUCLEAR LEVEL SPACINGS. A. G. W. Cameron (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Can. J. Phys. 36, 1040-57(1958) Aug.

T. D. Newton's shell-dependent level spacing formula depends upon the densities of single-particle orbits near the Fermi level in the nucleon gas. It has been found that that these densities can be computed by taking appropriate averages of the second differences between adjacent atomic masses, using the writer's semiempirical mass formula from which electrostatic and pairing energy terms have been omitted. With this procedure, observed nuclear level spacings have been fitted with a root mean square error factor of 1.74. This fit shows that the level spacings are proportional to $(2J + 1)^{-1}$ to a good approximation. Since the average density of single-particle orbits depends on the nuclear excitation energy, and since its computation takes a long time even with an electronic computer, an approximation formula with five coefficients has been fitted to the computed orbit densities for each Z and N in the ranges $10 \leq Z \leq 109$ and $10 \leq N \leq 189$. These coefficients are tabulated. (auth)

15811

MEASUREMENT OF THE AVERAGE NUMBER OF PROMPT NEUTRONS EMITTED IN THE FISSION OF Th^{232} INDUCED BY 14 Mev NEUTRONS. Jean Leroy. Compt. rend. 247, 200-2(1958) July 16. (In French)

The average number ν^{232} of prompt neutrons emitted in the fission of Th^{232} induced by 14-Mev neutrons was measured by comparison with the average number ν^{238} of prompt neutrons emitted in the fission of U^{238} by 14-Mev neutrons. The value obtained was 4.64 ± 0.2. (tr-auth)

15812

COULOMB EXCITATION OF Pt^{194} AND Pt^{195}. R. Barloutaud, T. Grjebine, Pl Lehmann, A. Leveque, J. Quidort, and G. M. Temmer (S.R.N.B.E., C.E.N., Saclay, France). J. phys. radium 19, 570-1(1958) May. (In French)

The 620-kev level of Pt^{194} was studied by measuring simultaneously the total coincidences and the fortuitous coincidences. A value of 0.49 ± 0.15 was found for the ratio of the reduced probabilities of the 293-kev and 328-kev transitions. The 210-kev and 300-kev transitions in coincidence with 210-kev photons of Pt^{195} were studied. The comparison of the direct spectra obtained with enriched targets and with natural targets showed the existence of gamma radiations of 420 kev and with less certainty 710 kev. These results are interpreted by a discussion of the level scheme of Pt^{195}. (J.S.R.)

15813

COULOMB EXCITATION. A. M. K. van Beek (Natuurkundig Laboratorium Rijksuniversiteit, Groningen, Netherlands). Ned. Tijkschr. Naturk. 23, 221-32(1957) Sept. (In Dutch)

A review is presented on the theoretical and experimental work done on Coulomb excitation in the last few years. 9 references. (J.S.R.)

15814

NEUTRON CROSS SECTIONS AND SCATTERING LENGTHS OF Cu^{63} AND Cu^{65}. D. T. Keating, W. J. Neidhardt, and A. N. Goland (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 111, 261-3(1958) July 1.

It is of interest to know whether the thermal-neutron scattering lengths of Cu^{63} or Cu^{65} are significantly different from natural copper. From measurements of the intensity of the (111) reflections of natural and isotopically enriched samples, the scattering lengths of Cu^{63}, Cu^{65}, and natural Cu are found to be $(+0.672 + 0.015) \times 10^{-12}$ cm, $(+1.109 \pm 0.019) \times 10^{-12}$ cm, and $(+0.790 \pm 0.023) \times 10^{-12}$ cm, respectively. The incoherent and absorption cross sections for Cu^{63} and Cu^{65} are deduced from the values of the cross sections of Cu^{63} and natural copper. The (spin) incoherent cross sections of the two isotopes are zero within the accuracy of the data and the incoherent cross section of natural copper is 0.4004 ± 0.1416 barn. The absorption cross sections for Cu^{63}, Cu^{65}, and natural Cu are $(2.512 \pm 0.058)\lambda$, $(1.459 \pm 0.144)\lambda$, and $(2.1728 \pm 0.0182)\lambda$ barns, respectively, where λ is in angstroms. (auth)

15815

DOUBLET SEPARATION IN NUCLEI FROM SIGNELL-MARSHAK POTENTIAL. B. P. Nigam and M. K. Sundaresan (National Research Council, Ottawa, Can.). Phys. Rev. 111, 284-5(1958) July 1.

The spin-orbit splittings for the $l = 1$ and $l = 3$ levels of Ca^{41} and $l = 2$ level of O^{17} have been calculated in the spirit of Brueckner's theory in the first Born approximation from the spin-orbit term that Marshak and Signell have added to the two-nucleon Gartenhaus potential. The results obtained are much larger than those obtained from the conventional tensor force in second order. (auth)

15816

SPINS OF INDIUM-109, INDIUM-110m, AND INDIUM-111. Lawrence L. Marino, Wesley B. Ewbank, William A Nierenberg, et al. (Univ. of California, Berkeley). Phys. Rev. 111, 286-7(1958) July 1.

The nuclear spins of three neutron-deficient radioactive isotopes of indium have been measured by the use of the atomic-beam magnetic-resonance technique. Results are $I = 9/2$ for 4.3-hr In^{109}; $I = 7$ for 5.0-hr In^{110m}; and $I = 9/2$ for 2.8-day In^{111}. (auth)

15817

EFFECT OF THE HYPERFINE SPLITTING OF A μ-MESONIC ATOM ON ITS LIFETIME. J. Bernstein, T. D. Lee, and C. N. Yang (Inst. for Advanced Study, Princeton, N. J.). Phys. Rev. 111, 313-15(1958) July 1.

The lifetime of a μ-mesonic atom depends on its hyperfine state because of the spin dependence of the interaction between the μ^- meson and the capturing proton. The small lifetime difference between the hyperfine states is estimated in a one-particle model. Possible experimental detection of such a difference is discussed. (auth)

15818

IMPLICATIONS OF THE DIRECT-INTERACTION MODEL FOR NUCLEAR STRUCTURE. Kenneth M. Watson (Univ. of California, Berkeley). Revs. Modern Phys. 30, 565-8(1958) Apr.

Several developments in technique of scattering

theory have made it possible to put the direct-interaction model into a quantitative form. This quantitative form is discussed. The possibility of using nuclear interaction to learn something about the forces between nucleons and strange particles is explored. (W.D.M.)

15819

DIRECTIONAL CORRELATION OBSERVATIONS ON Ag^{110m} (270 d). U. Cappeller, E. Ganssauge, and W. Ullrich (Univ. of Marburg, Germany). Z. Naturforsch. 13a, 559(1958) July. (In German)

The angular momentum and parity of the excited levels of Cd^{110} were determined from angular correlations between the γ radiation of Ag^{110m}. The results were:

656-kev state	2, +
1539-kev state	4, (+)
2484-kev state	4, (−)
2920-kev state	5, −
2148-kev state	4, (+)

The multipolarity of the various γ radiations were determined to be:

656-kev radiation	E2
760-kev radiation	(M2)
883-kev radiation	(E2)
945-kev radiation	(E1)
1382-kev radiation	99% M2 and 1% E1
1491-kev radiation	(E2)

(J.S.R.)

15820

THE NUMBER OF ACTIVE ATOMS AND IMMINENT DECAY EVENTS IN SPECIMENS WITH INTEGRATED FRAGMENT ACTIVITY. V. A. Blinov and L. I. Gedeonov. pp. 96-103 in "Fizika i Teplotekhnika Reaktorov." Moscow, Publishing House on Atomic Power, 1958. 213p. (In Russian)

The number of active atoms in imminent decay events was calculated for prompt fission of U^{235}. The results were compared with the number of atoms in the integrated fragment activity of two specimens of Y^{91} and one specimen of Ce^{141}. (R.V.J.)

15821

MEASUREMENTS OF THE $Xe^{135}(n,\gamma)Xe^{136}$ REACTION CROSS SECTION FOR THE THERMAL NEUTRON SPECTRA OF A NUCLEAR POWER PLANT REACTOR. E. F. Makarov and Z. D. Samoilova. pp. 112-22 in "Fizika i Teplotekhnika Reaktorov." Moscow, Publishing House on Atomic Power, 1958. 213p. (In Russian)

A burnout or deactivation method was used for measuring the mean $\sigma_r(T)$ of the $Xe^{135}(n,\gamma)Xe^{136}$ reaction. The cross section for the Maxavellian spectra of thermal neutrons at 800 ± 50°K was found to be $(1.75 \pm 1.15) \times 10^6$ b. The advantages and disadvantages of the method are discussed. (R.V.J.)

Nuclear Reactors

Refer also to abstracts 15273, 15477, 16056, 16057, 16058, 16059, 16060, 16061, 16062, 16063, 16065, 16066, 16067, 16068, 16069, and 16070.

15822 AECU-3816

Power Reactor Development Co., Detroit and Detroit Edison Co., Detroit.

AN INTEGRATED DESIGN OF REACTOR AND TURBINE GENERATOR SECTIONS OF THE ENRICO FERMI ATOMIC POWER PLANT. R. C. Kirkby and C. M. Heidel. 36p. $6.30(ph OTS); $3.00(mf OTS).

The design of the steam-generating system and the turbine generator system of the Enrico Fermi power plant is given. The terms of the agreement between The Power Reactor Development Company and The Detroit Edison Company are discussed. (W.D.M.)

15823 ANL-5800

Argonne National Lab., Lemont, Ill.

REACTOR PHYSICS CONSTANTS. [1958]. 540p. Contract W-31-109-eng-38. $7.00(OTS).

This compilation of reactor physics constants, based on data available up to March 15, 1958, is the first publication of the Reactor Physics Constants Center (RPCC). The primary objective of the RPCC is the periodic compilation of the latest and best values of the constants, recipes, formulas, etc., which are necessary to calculate reactor characteristics. (W.D.M.)

15824 ANL-5901

Argonne National Lab., Lemont, Ill.

INSTALLATION AND INTERFERENCE PROBLEMS IN REACTOR INSTRUMENTATION SYSTEMS. William K. Brookshier. Aug. 1958. 12p. Contract W-31-109-eng-38. $0.50(OTS).

Reactor control instrumentation systems may be subject to a variety of extraneous signals. Five types are discussed: signals involving high-frequency components which may gain access to critical circuits through wiring that lacks suitable RF filtering; current signals due to mechanical shocking or flexing of cables; extraneous ion chamber signals, including displacement currents due to fluctuations in the polarizing voltage, as well as currents caused by mechanically induced changes in ion chamber capacity; signals whose origin is magnetic induction into cable loops; and signals involving magnetic induction and ohmic induction into auxiliary loops created by multiple ground connections. The emphasis is placed on magnetic induction and means of eliminating it. (auth)

15825 APAE-Memo-136

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

SHOCK HYDRODYNAMICS OF AN EXPLODING STEAM PRESSURE VESSEL. Final Report. E. F. Lype and F. B. Porzel. Nov. 25, 1955. 17p. ARF Project M 526. For Alco Products, Inc. Contract AT(11-1)-318. $3.30(ph OTS); $2.40(mf OTS).

The purpose of these investigations is to determine, grossly and simply, if a shock hazard exists from an explosive failure of the pressurizer vessel within the vapor container. Because of the geographical location of the reactor, an explosive failure which ruptured the vapor container might release radioactive contamination from the reactor to nearby inhabited communities. The study is considered more as a generic problem than of a specific design and is concerned with the shock hydrodynamics of an exploding steam vessel. (auth)

15826 BAW-1023 and Suppl. 1

Babcock and Wilcox Co., Atomic Energy Div., Lynchburg, Va.

NUCLEAR MERCHANT SHIP REACTOR CRITICAL EXPERIMENT. Hazards Evaluation Final Report. Oct. 1957. Includes Amendment No. 1, Docket 50-13, dated Dec. 13, 1957 (Suppl. 1). 96p. Contract AT(30-3)-274.

The potential hazards of operating the Nuclear Merchant Ship Reactor critical experiment facility are evaluated. Hydrological, meteorological, and seismological studies made for this site for the Consolidated Edison Reactor are applicable to the NMSR and so are not included. The new wing and its equipment are described, and design details of the critical assembly are given. Experiments conducted here will seek to deter-

mine the nuclear characteristics of an advanced design pressurized water converter-type reactor. Security measures used and emergency plans set up are described. (T.R.H.)

15827 BAW-1045
Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va.
EVALUATION OF INTERNALLY COOLED LIQUID METAL FUEL REACTORS. Mar. 1958. 37p. Contract AT(30-1)-1940. $1.25(OTS).

An evaluation is made of the internal cooling concept as applied to thermal breeders of the liquid-metal fuel reactor type. The major areas of investigation are maintenance, technical feasibility, and over-all power cost. Three specific internally-cooled reactor designs are discussed in detail. Where pertinent, comparisons are made with the externally-cooled type. It is concluded that the internally-cooled concept is not as attractive as the externally-cooled concept. (auth)

15828 BAW-1049-1
Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va.
LIQUID METAL FUEL REACTOR EXPERIMENT — CRITICAL EXPERIMENT. Final Hazards Evaluation. T. C. Engelder, ed. June 1958. 115p. Contract AT(30-1)-1940. $2.50(OTS).

The LMFRE is described briefly. It is a graphite moderated, graphite reflected reactor, using as fuel a circulating solution of U^{235} in liquid bismuth, which transports heat to an external heat rejection system. The critical experiment program is outlined. The basic information to be obtained is the critical size and concentration of a series of assemblies in which the uranium concentration and reflector thickness are varied. Control rod experiments are planned, as well as test hole effects, and effects of fuel in the reflectors and plenums. The critical assembly is constructed in two halves, one each on a movable and stationary table. The core is constructed of several thousand bars of bismuth and graphite, and fully-enriched U-Al alloy strips, held together in graphite channels. The reflector is built of large blocks of graphite. The table drive system and supporting structure, control rods and drives, neutron source and drive, and instrumentation are discussed. The storage and assembling of fuel, approach to critical, and operating procedures conform to standard practice. At least two large safety rods are cocked in each assembly for fast acting safety. Ultimate shutdown is provided by table separation. A fundamental reactivity addition rate limitation is 0.0005/sec, which applies to both control rod and table movement. Various accidents are discussed. The maximum credible accident is defined in terms of a loading error combined with failures in the safety circuits and table drive mechanism and leads to a reactivity addition of 0.0015/sec up to 2% total excess reactivity. The ultimate shutdown mechanism is a combination of fuel boiling and graphite heating. Over a range of step reactivity additions up to 2% and ramps up to 2%/sec, and for various conditions of heat transfer, the maximum possible energy release to terminate the excursion is 170Mw-sec. The environmental hazard due to 100% release of the fission product activity generated in the excursion is considered. The maximum dose to the nearest permanent resident, located 2500 ft from the laboratory, in no case represents a serious hazard. (auth)

15829 BMI-1240(Rev.)
Battelle Memorial Inst., Columbus, Ohio.
HAZARDS SUMMARY REPORT FOR THE GCRE CRITICAL-ASSEMBLY EXPERIMENTS. William S. Hogan, David A. Dingee, Francis J. Jankowski, and Joel W. Chastain. July 22, 1958. 88p. Contract W-7405-eng-92. $2.50(OTS).

Critical experiments are described, and the hazards attendant to these experiments are evaluated for a gas-cooled water-moderated reactor design. Shutdown control of the critical assembly is achieved by cadmium control blades and by dumping the water into a storage tank. The maximum normal rate of reactivity addition is limited to an estimated 0.04 per cent per sec for all remotely controlled operations. The system is interlocked to insure that safe operational procedures are followed. Hazard calculations are made to determine the dosage from direct radiation, fall-out, and inhalation from a radioactive cloud resulting from an accident. The exclusion area is shown to be adequate for even the maximum hypothetical accident. (auth)

15830 CF-54-8-241
Oak Ridge School of Reactor Technology, Tenn.
SHIELDING FOR NUCLEAR ROCKETS. James E. Norman. Aug. 1954. Decl. Nov. 15, 1957. 69p. $10.80(ph OTS); $3.90(mf OTS).

A procedure for computation of effective source strength of a rocket vehicle reactor for each radiation considered is developed. A method of computation of attenuation of reactor gamma leakage by propellant is accomplished by dividing this radiation into energy groups of arbitrary range, and considering the effect of propellant on each group. The effect of thermal and fast neutron leakage is examined and contribution to dose estimated. Methods of computation of the attenuation of air scattered gamma radiation and air scattered neutrons incident upon the vehicle payload compartment are developed. Procedure for combining reactor source strength, attenuation, and vehicle flight characteristics to estimate integrated payload compartment dose over powered flight time is developed. Possible dimensions and configurations are computed, for a number of vehicles of various takeoff weights and burnout velocities. Utilizing the methods developed for reactor source strength and radiation attenuation, integrated dose flight time is computed for one specific vehicle. (auth)

15831 CF-58-7-117
Oak Ridge National Lab., Tenn.
ULTRA HIGH FLUX RESEARCH REACTORS. J. A. Lane. July 31, 1958. 147p. Contract [W-7405-eng-26]. $22.80(ph OTS); $7.20(mf OTS).

Verbatim transcriptions of nine seminars on ultra high flux research reactors are revised and collected here. The seminars included: production of transuranic elements, isotope production using high fluxes, high fluxes for neutron diffraction experiments and velocity selector experiments, solid state physics and the materials for high flux reactors, physics of flux-trap and other ultra high flux reactors, and design considerations of aqueous flux-trap reactors. (T.R.H.)

15832 CF-58-8-37
Oak Ridge National Lab., Tenn.
SUPPLEMENTARY COMMENTS TO ORNL CF-58-5-97. L. G. Epel. Aug. 12, 1958. 14p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

In a previous report (ORNL CF 58-5-97) the temperature structure in the GCR-2 fuel elements and coolant stream was presented. The analysis depended on several assumptions, two of which were more controversial than the others. One was the stipulation that the "equilibrium" temperature profile (i.e., a temperature profile that did not change with axial location) had been achieved at the cross section being studied. The other simplifica-

tion made was that the coolant could be thought of as consisting of two regions of constant thermal conductivity, one being the usual thermal conductivity and the other being a space average of conductivities found by using the Martinelli analogy which attempts to take into account the effects of eddy diffusivity. This report lends validity to the first assumption and verifies that the effect of the latter mentioned approximation is as was suggested in the aforementioned report. To make the problem more tractable analytically, one dimensional rectangular geometry was chosen. (auth)

15833 CF-58-8-77
Oak Ridge National Lab., Tenn.
ESTIMATE OF POTENTIAL FUEL REPROCESSING, REVISION NO. 24—PART A. J. W. Ullmann. Aug. 22, 1958. 7p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

The power and estimated reprocessing load are tabulated for existing and proposed United States and United States built reactors over 10 kw thermal. (auth)

15834 CWR-400-3
Curtiss-Wright Corp. Research Div., Quehanna, Penna.
REACTOR ANALYTIC TECHNIQUES. Devereux L. Kavanagh and William J. Roberts. June 1958. 90p.

The nuclear analysis of reactor systems involves the study of many different system parameters. The theories applied are varied and, in several instances, seemingly contradictory in nature. Also, the analytical tools available are unfamiliar to most of those just entering the field, such as, for example, the use of high speed electronic digital computers. The purpose of this report is to present some of the analyses required and at least one approach to the calculational aspects of each analysis. No attempt at rigor is made and the theories and approximations used are not claimed to be either standard in the field or superior to approaches used elsewhere. (auth)

15835 HW-56009
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
A RE-OPTIMIZATION OF SEVERAL PROCESS PARAMETERS FOR THE GAS COOLED REACTOR CONCEPT. R. C. Walker, G. E. Wade, E. R. Rudock, W. A. Massena, and E. R. Astley. June 30, 1958. 93p. Contract [W-31-109-Eng-52]. $15.30(ph OTS); $5.40(mf OTS).

The additional or supplementary conclusions regarding the gas-cooled reactor concept which have been derived from this study are: The graphite-to-uranium ratio is relatively insensitive to variations in the other process conditions considered and for most of the more optimum cases falls in the range of 70 to 80 to one (atom-to-atom ratio). Power costs are relatively unaffected by nominal differences in reactor ΔT with optimum power costs for the cases studied falling within the range of 500 to 525°F. The length-to-diameter ratio of the reactor core appears to be a strong function of the coolant flow area ratio with optimum values in the range of 0.6 to 1.0, the lower values being associated with the smaller flow area ratios. Specific tube power is another process variable which is strongly affected by the flow area selected and for the range of combinations investigated, falls within the range of 75 to 140 kw/ft with lower values again being related to the lower flow area ratios. Initial enrichment requirements are strongly affected by an increase in the flow area ratio although less fuel is contained in the lattice for a given N_g/N_u ratio. This paradox occurs due to the fact that optimum power density increases with increasing flow channel areas. The higher fuel specific power necessitates subdividing the total fuel volume into an increased number of smaller rods which have correspondingly greater amounts of stainless steel cladding and thus higher fuel enrichment requirements. Net power costs for many of the cases studied fell within a rather narrow range; in fact, the optimum values for the three flow area ratios fall within a 0.24 mill/kwh bracket. However, this can be expected from a study of this nature and while different bases for capital and fuel cost estimates could alter the optimum ranges somewhat, the values resulting from this study are probably not too far in error since the 0.24 mill/kwh range cited above is equivalent to approximately $500,000/yr in operating or fuel costs or $3,350,000 in capital investment for a 300 Mw plant and the method of cost analysis assumed. (auth)

15836 HW-56694
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
GEOMETRY CORRECTIONS FOR HANFORD SHIELD TEST. D. E. Wood. June 25, 1958. Decl. Sept. 17, 1958. 26p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

Shield tests at Hanford have included attenuation measurements for iron–masonite laminations, several high-density concretes, and ordinary Portland cement concrete in the DR vertical shield test wells. In these tests, the fast and slow neutron fluxes were measured (using sulfur and gold foils) as a function of distance in a 4-foot thick test specimen. (auth)

15837 HW-56801
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
EXTRUSION CLADDING URANIUM WITH ALUMINUM USING THE "SCHLOEMANN" CABLE-CLADDING PRESS-MECHANICAL ASPECTS. G. F. Jackey. July 21, 1958. 41p. Contract [W-31-109-Eng-52]. $7.80(ph OTS); $3.30(mf OTS).

The tests demonstrated the mechanical feasibility of extrusion cladding the external surface of cylindrical geometry fuel elements with a 50 to 100-mil thick jacket, employing a wide range of processing conditions and extrusion tool configurations. This demonstration is a favorable indication of plant-scale mechanical feasibility, considering that satisfactory mechanical performance was achieved with the minimum of development effort on extrusion tool design, and only minor modifications to the equipment assembly. Based on the extrusion cladding experience of Battelle, Savannah River Laboratories, and Atomic Energy of Canada Ltd., it is believed that satisfactory jacket-core bonding might have been achieved over a considerable span of the operating conditions with feasible improvements in the inertness of the preheating furnace atmosphere and the adhesion of the uranium and nickel plating. (auth)

15838 HW-56893
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
A COMPARISON OF ELASTIC STRESSES IN SOLID AND I AND E FUEL ELEMENTS. O. Eugene Adams, Jr. July 23, 1958. 17p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

The elastic thermal stresses in solid and I and E fuel elements are compared under the assumptions that either their radial temperature drops or their power generation per unit length is equal. (T.R.H.)

15839 IDO-23(Pt.I(Del.) and Pt.II)
Kaiser Engineers Div., Henry J. Kaiser Co., Oakland, Calif.
ENGINEERING TEST REACTOR PROJECT. PART I. COMPLETION REPORT. DESIGN: MAY 19, 1955–MAY 31, 1957. CONSTRUCTION AND INSPECTION: OCTOBER 6, 1955–AUGUST 31, 1957. PART II. FINAL COST REPORT. Nov. 15, 1957. 307p. Contracts AT(10-1)-770 and AT(10-1)-785. $5.00(OTS).

The Engineering Test Reactor is water-cooled and moderated, fueled with enriched uranium, and contains a core of 49 fuel elements arranged in a square array. Within the core are 16 control rods and numerous penetrations for experiments. The reactor has a thermal rating of 175 Mw, and, for experiments, the reactor produces an average thermal flux in the core of approximately 4×10^{14} n/(cm^2)(sec) and a fast flux of approximately 1.5×10^{15} n/(cm^2)(sec). In addition to the reactor, the ETR Facility includes such major equipment as a storage canal, primary and secondary coolant systems, experimental facilities, associated buildings, and extensions to existing utilities. The ETR was designed to provide experimental facilities for performing engineering tests on fuel elements and components of nuclear plants in very high neutron flux regions. The reactor and its appurtenances were designed to augment and complement the existing MTR facilities, relying on the MTR for some auxiliary facilities. (auth)

15840 IDO-16437
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
QUARTERLY PROGRESS REPORT [FOR] OCTOBER, NOVEMBER, DECEMBER, 1957. G. O. Bright, ed. Mar. 21, 1958. 84p. Contract AT(10-1)-205. $2.25 (OTS).

Spert I. Static tests on the B cores were completed. The control rod worth and temperature coefficient were determined for each of the B cores: the 24 fuel plates/assembly, 32 assembly core (B-24/32); 16 fuel plates/assembly, 40 assembly core (B-16/40); and the 12 fuel plates/assembly, 64 assembly core (B-12/64). Void coefficient studies were performed on each core, and a slightly positive coefficient was found in the central portion of the B-12/64 core. Flux distributions were measured for each core. The kinetic testing program was initiated and a number of transient experiments were performed, with results yet in the preliminary stage. Data Reduction and Interpretation. Almost all of the usable data from the Spert I-A core tests have been reduced. A cross-index is being set up to facilitate finding desired test data. Reactivity calculations on boiling step-transients continues. Theoretical. Reactor statics calculations on the Spert I-B core are in progress. These include effects on reactivity of temperature, voids, and excess fuel for each of three fuel assembly types. Calculations were made of the critical mass of a B-type core with D_2O moderator and reflector, such as might be used in Spert II. Instrumentation. The instrumentation section has completed modification, maintenance, testing, and calibration of basic transient instrumentation for the "B" core experiments. A semi-automatic system for calibration of thermocouple channels has resulted in decreased calibration and data reduction time. Now techniques for attaching thermocouples to fuel plates are under test in "B" core transient experiments. The area monitoring system was modified for better operation in high humidity conditions. Special projects and investigations include construction and use of a frequency modulated current source, construction of special purpose wide-band a-c amplifiers, construction of a gamma chamber for use in radiation sensitivity tests, and installation of convenience outlets at the reactor pit area which are controlled at the console. Engineering. A review of the system operation indicates that the cold trap for recovery of D_2O vapor is adequate. A piping modification which will allow use of the small heat exchanger for light water cooling is contemplated. Corrosion studies on aluminum have resulted in the selection of 6061 aluminum for the core structure. Tests on the Spert III control rods indicate that redesign of the upper end box section will be necessary because of the large pressure drop across it. Means for reducing flux peaking at the junction of the fuel and poison sections are under investigation. Calculations of the after-shutdown activity indicate that normal shutdown operation can be performed. Studies are in progress on the heat transfer characteristics of the reactor and the use of soluble poison for reactor control. (For preceding period see IDO-16416.) (D.E.B.)

15841 IDO-24026
Kaiser Engineers Div., Henry J. Kaiser Co., Oakland, Calif. and Nuclear Products-Erco Div., ACF Industries, Inc., Washington, D. C.
COMPARISON OF OPTIMUM NATURAL URANIUM NUCLEAR POWER PLANT AND OPTIMUM ENRICHED URANIUM NUCLEAR POWER PLANT. (GAS COOLED POWER REACTORS). Report No. 58-19-RE. Aug. 1958. 237p. Contract AT(10-1)-925. $6.50(OTS).

The designs of an optimum natural uranium power plant and an optimum partially enriched uranium power plant, both using CO_2 as a coolant, are compared. The basis for optimization of both plants is set forth and a description of the design of each plant is included. Those features of design, construction, and economic considerations which differ between the two optimum plants are discussed in detail. The design of each of the plants incorporates new advances in technology and the best features of similar plants now operating, or under construction, to provide net plant efficiency higher than has thus far been achieved in nuclear plants. (auth)

15842 IGRL-IB/R-24
United Kingdom Atomic Energy Authority. Industrial Group H. Q., Risley, Lancs, England.
NUCLEAR PROPULSION FOR SHIPS. Information Bibliography. B. Yates. 1958. 53p.

The interests of both ship and reactor designers were considered in compiling this wide selection of book, unclassified report, and journal references to the use of nuclear power for ship propulsion. Sources used were U.K. and U.S. reports abstracts, Nuclear Science Abstracts, Engineering Index (1948-56) Industrial Arts Index (1957-), and the index to the "Information Bulletin." (429 references.) (auth)

15843 KAPL-M-SMS-21 and Suppl. A
Knolls Atomic Power Lab., Schenectady, N. Y.
S3G/S4G PROJECT DEVELOPMENT AND TESTING OF A HOT CRUD FILTER AND FILTRATE SAMPLING UNIT. W. F. Mathewson. Mar. 27, 1956. 21p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

A crud filter and filtrate sampling unit have been developed for measuring the insoluble, colloidal and soluble concentration of steel corrosion products at SAR temperature and pressures. The data given in this report are for concentrations found in the TF-20 carbon steel loop. If proper flow conditions, through the filter, are met (0.05 gpm), the porous metal disk with a graph-

ite precoat is in the order of 98% efficient. The samples collected in the filtrate sampling unit (autoclave) varied considerably in metal concentrations. Since the metal ions are at saturation, this variation is probably due to fluctuation in the colloid concentration, which seems to be proportional to the insoluble concentration. As yet it has been impossible to measure the solubles and colloids separately, but efforts are being made to accomplish this. (auth)

15844 MUC-CAH-7

[Argonne National Lab., Lemont, Ill.]
TEMPERATURES AND THERMAL STRESSES IN PILE FUEL RODS. Clyde A. Hutchison, Jr. Apr. 15, 1946. Decl. Aug. 11, 1958. 23p. $4.80(ph OTS); $2.70(mf OTS).

The general equations relating temperatures and thermal stresses in pile fuel rods to their physical properties are given for the approximation of infinitely long rods. The relationships between the fuel rod stresses and those in a cooling cylinder are given. The available measurements of pertinent physical properties are summarized. Numerical calculations of temperatures and stresses are made for the case of a beryllium oxide–uranium oxide pile. (auth)

15845 NAA-SR-1880

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
RESEARCH AND DEVELOPMENT PROGRAM FOR AN OMR POWER PLANT FOR PROPULSION OF A 38,000-DWT TANKER. Mar. 18, 1957. 11p. Contract AT-11-1-GEN-8. $0.50(OTS).

NAA-SR-1851, with supplement, and NAA-SR-1879 present information related to this report.

The separate projects of the Maritime Organic Moderated Reactor program are described, and the scheduling and cost estimates are given. (T.R.H.)

15846 NAA-SR-Memo-1117

North American Aviation Inc., [Downey, Calif.]
PHOTOGRAPHY AND STUDY OF FLOW PATTERNS CONCERNING THE SRE FUEL ELEMENT ASSEMBLY. William J. Freede. Oct. 11, 1954. Decl. May 17, 1956. 10p. $1.80(ph OTS); $1.80(mf OTS).

High-speed motion pictures of flow patterns produced along sections of the SRE fuel element assembly were made to evaluate design and performance characteristics. Sixteen mesh and smaller sawdust particles weighted with CCl_4 placed in the hydro-loop were photographed and particle movement logged. With these data, various flow pattern characteristics were determined. (J.R.D.)

15847 NAA-SR-Memo-2067

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
OMR CELL CODE FOR THE IBM 704. W. W. Davis. Aug. 27, 1957. 27p. $4.80(ph OTS); $2.70(mf OTS).

The nuclear constants required to solve the reactor problem for an OMR core were calculated on a high-speed computer. A description is presented, including equations, of a cell code written for the OMR on the IBM-704. An appendix includes the data sheets, results sheet, and illustrations of the mathematical model employed. (auth)

15848 NDA-84-10

Nuclear Development Corp. of America, White Plains, N. Y.
SDR MOCKUP—AN OPERATIONAL DEMONSTRATION OF SODIUM–WATER SYSTEM. C. Bolta, J. Cihi, and D. Lee. Aug. 25, 1958. 35p. Contract AT(30-3)-256. $7.80(ph OTS); $3.30(mf OTS).

Preliminary design of a 10-Mw Sodium Deuterium Reactor (SDR) is presently in progress at Nuclear Development Corporation of America (NDA) under a contract from the U. S. Atomic Energy Commission. The reactor is sodium-cooled and D_2O moderated. A mockup having the characteristic features of the sodium-barrier-water system in the SDR core region has been designed, constructed, and operated successfully under both normal and aggravated conditions. The history of the mockup demonstration is reported herein. (auth)

15849 NP-6932

MSA Research Corp., Callery, Penna.
PROGRESS REPORT NO. 47 FOR JUNE AND JULY 1958. W. J. Posey, ed. Aug. 15, 1958. 27p. Contract NObs-65426.

Results on corrected NaK conductance for film boiling with H_2O inside tubes are presented. Investigations on the chloride stress corrosion of type 304 stainless steel were continued. The possibility of a hydrogen explosion and fission product release from the molten Zr–steam and/or water reaction in a core meltdown is being investigated by melting an irradiated Zr–U subassembly in a steam atmosphere. A study is being undertaken to evaluate analytical techniques for Cl^- with particular application to boiler and condenser water. (For preceding period see NP-6787.) (W.L.H.)

15850 ORNL-2273

Oak Ridge National Lab., Tenn.
THROW-AWAY FUEL CYCLE. J. W. Ullmann. Mar. 7, 1957. Decl. Sept. 2, 1958. 12p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40(mf OTS).

Estimates are made of the cost of reprocessing irradiated fuel. Break-even costs for fuel discard vs. recovery are computed for U as a function of enrichment and burnup, U^{235} as a function of burnup, and Th for two specific cases. (auth)

15851 PRDC-TR-12

Power Reactor Development Co., Detroit.
MONTHLY TECHNICAL REPORT [FOR] JUNE 1958. 11p. Contract AT(11-1)-476. $3.30(ph OTS); $2.40 (mf OTS).

The status of the design and fabrication of major components being procured for the Reactor Components Test is shown. Progress in nuclear engineering materials, fuel engineering, reactor vessel engineering, mechanical handling, liquid metal and steam system, and test operations is summarized. (For preceding period see PRDC-TR-11.) (W.L.H.)

15852 RWC-22-122

Ramo-Wooldridge Corp. Electronic Research Lab., Los Angeles.
THEORY OF SMALL OSCILLATIONS IN BOILING WATER NUCLEAR REACTORS. H. C. Corben, D. B. Langmuir, and R. S. Margulies. June 1958. 36p. Contract AT(04-3)-165. $1.00(OTS).

Various models proposed by several authors to describe small oscillations of the power of a reactor are shown to lead to a feedback equation between δk_{ex} and $\delta\phi = \phi - \phi_0$ of the form $(d/dt + 1/\tau_1)(d/dt + 1/\tau_2)$ $\delta k_{ex} = -C\delta\phi$, where τ_1, τ_2, and C are constants. Algebraic expressions are derived for grain and phase angle from this equation, and equated to the corresponding expressions obtained from the space-independent pile-kinetic equations, thereby obtaining two expressions for the frequency $\omega/2\pi$ and damping μ of small power oscillations as functions of average power ϕ_0 and the three parameters. Measurement of ω, μ, and ϕ_0 for a particular transient then yields two relations between τ_1, τ_2, and C. Corresponding restrictions on the values of these

parameters may then be read off from the appended graphs. The values of these constants depend upon the detailed thermal, hydrodynamic and other processes occurring within the reactor. The theory thus provides a means of predicting the oscillatory behavior of the power from the time constants of the detailed processes, and conversely of determining the values of any two of these constants (provided the third is known) from a single measurement of ω, μ, and ϕ_0. Whenever τ_1 or τ_2 is less than a value shown in one of the plots, undamped oscillations cannot occur. (auth)

15853 TID-7552

Idaho Operations Office, AEC; Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho; Kaiser Engineers Div., Henry J. Kaiser Co., Oakland, Calif.; and General Electric Co. Atomic Power Equipment Dept., Schenectady, N. Y.

DESIGN, CONSTRUCTION, AND OPERATION OF ENGINEERING TEST REACTOR. Papers Presented at Engineering Test Reactor Industrial Preview, Idaho Falls, Idaho, October 2 and 3, 1957. 218p.

Papers are included on need for testing reactors, experimental facilities and program, operating philosophy procedures and costs, operational safety, core characteristics and control system, vessel and shielding, cooling system, materials and fabrication problems, design considerations of hazards and safety, construction, and inspection. (W.D.M.)

15854 WAPD-ITL-B(C)-1564

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
PWR PRIMARY PLANT EQUATIONS. H. Estrada, Jr. May 18, 1954. Decl. Sept. 15, 1958. 29p. $4.80(ph OTS); $2.70(mf OTS).

A set of differential equations describing the operation of the PWR power plant is presented. (W.L.H.)

15855 WAPD-MRP-74

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
PRESSURIZED WATER REACTOR (PWR) PROJECT TECHNICAL PROGRESS REPORT FOR THE PERIOD APRIL 24, 1958 TO JUNE 23, 1958. 87p. Contract AT-11-1-GEN-14. $2.25(OTS).

A photoelastic study of the Core 1 Seed 2 subassembly was completed. The conceptual design for the Seed 2 metal and inlet water temperature instrumentation was established. Conceptual designs of Core 2 were established for the blanket and seed fuel assemblies. The results of a study of electron beam welding of zirconium-base alloys show that good penetration and weld cleanliness can be obtained in simulated PWR Core 2 fuel elements. Exposure of nickel-diffusion-bonded Zircaloy and solid Zircaloy tensile specimens in a high pressure-hot water loop to a maximum integrated flux of 6.53×10^{20} nvt resulted in severe hydride embrittlement and a considerable reduction in tensile strength in the nickel-diffusion-bonded samples and little change in the solid Zircaloy samples. Examination of the prototype Core 1 blanket rods which operated 14 months in the X-1 loop to a maximum exposure of 12,000 Mwd/T showed no apparent change in the microstructure of the UO_2 of the undefected rods and grain growth of the UO_2 in the defected rod. The temperature coefficient of reactivity was remeasured for Core 1 after 550 EFPH and was found to be essentially unchanged. (For preceding period see WAPD-MRP-73.) (W.D.M.)

15856 WAPD-PWR-TE-11

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
PRECRITICAL PRIMARY SYSTEM CLEANUP. Test Evaluation T-612086; DL-S-181. B. J. Bates. July 11, 1958. 20p. PWR Project. Contract [AT-11-1-GEN-14]. $3.30(ph OTS); $2.40(mf OTS).

The tests conducted to assure that the Shippingport Pressurized Water Reactor primary systems were free of foreign material after Period II testing and prior to core insertion are described. The system was pronounced clean, both visually and quantitatively. (T.R.H.)

15857 WAPD-RDa-71

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
PWR REFERENCE FUEL ROD DESIGN. Jerome Sherman and Paul S. Sherba. [Aug. 1955]. Decl. Mar. 8, 1957. 25p. $4.80(ph OTS); $2.70(mf OTS).

The bases for the dimensions and tolerances of the component parts and the clearances in the assembly of a PWR reference fuel rod are presented. The large differential growth between the UO_2 pellets and the Zircaloy-2 produces strains in the cladding, and stress and strain analysis is based on a plasticity study. The results of this study show that the reference fuel rod is entirely satisfactory for operation at 100 Mw gross electrical output. (auth)

15858 WAPD-T-559

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE PWR FAILED ELEMENT DETECTION AND LOCATION SYSTEM. Paul W. Frank and Kenneth H. Vogel. [1957]. 17p. Contract AT-11-1-GEN-14.

Prepared for Presentation at the American Nuclear Society Conference, Pittsburgh, June 10-12, 1957.

The problem of detecting and locating fuel element failures for a recirculating system such as the Shippingport Pressurized Water Reactor was investigated. Theory was developed and discussed with relation to available data. It was concluded that the absolute performance of the PWR system cannot be predicted from available fuel element test data. This delayed neutron monitoring system should be superior to other practical alternatives, based on the theory. (T.R.H.)

15859 WAPD-T-776

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE EFFECT OF CORE CONFIGURATION AND COMPOSITION ON EXPERIMENTALLY DETERMINED EMPIRICAL CONTROL ROD ABSORPTION CROSS SECTIONS. R. S. Wick and J. D. Butler. Apr. 1958. 16p. Contract AT-11-1-GEN-14. $3.30(ph OTS); $2.40(mf OTS).

Submitted at the American Nuclear Society Meeting, June 2-5, 1958.

The treatment of control rods by a two-group diffusion theory model is discussed, and the results obtained from analyzing a series of critical assemblies of varying composition and configuration are presented. A four group description of control rods is discussed, and the results of reexamining the previous data with this improved model are shown to yield a more consistent treatment of the control rod. Some general conclusions and observations are presented. (W.D.M.)

15860 WASH-3(Rev.)

Reactor Safeguard Committee, AEC.
SUMMARY REPORT OF REACTOR SAFEGUARD COMMITTEE. Mar. 31, 1950. Decl. Mar. 18, 1957. 56p. $9.30(ph OTS); $3.60(mf OTS).

Reactor hazards are discussed generally as to blast damage, accidental release of activity to air, release of stored fission products, and off-gas stack activity. Mitigating measures such as reactor control devices, fission product containment, reactor design, and waste storage facilities are briefly outlined. The investigation

of six specific reactors by the committee is summarized. Appendices are included on: Estimate of Radiation from a Cloud Containing All of a Reactor's Fission Products; Radioactive Contamination by Precipitation; Plutonium Limits in Drinking Water; Radioactive Limits in Drinking Water Downstream; The Energy Developed in an Exploding Reactor; Chance of Disaster Due to Sabotage; Information Necessary to Evaluate the Safety of a Reactor; and a Table of Reactor Characteristics (13 reactors and reactor proving ground). (T.R.H.)

15861 WCAP-369(Rev.)

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh and Holmes and Narver, Inc., Los Angeles. FINAL SAFETY REPORT FOR THE WESTINGHOUSE TESTING REACTOR. Aug. 1958. 270p.

A description of the Westinghouse Testing Reactor (WTR), a heterogeneous water moderated and cooled reactor, and a detailed discussion of the precautions and safeguards that have been taken to insure safe operation of the reactor are presented. (W.D.M.)

15862 AEC-tr-3313

CALCULATION OF THE RATIO BETWEEN THE FLUX AT THE SURFACE AND THE AVERAGE FLUX (DISADVANTAGE FACTOR) FOR A CYLINDRICAL FUEL ELEMENT. (Beräkning av Förhållandet Randflöde till Medelflöde (Disadvantage Factor) för ett Cylindriskt Bränsleelement). I. Carlvik and B. Pershagen. Translated by W. K. Ergen (Oak Ridge National Lab.) from report AEF-68, Aktiebolaget Atomenergi, Stockholm, Oct. 24, 1956. 12p.

For calculating the thermal utilization and the diffusion length of heterogeneous reactors it is necessary to know the disadvantage factors for the different parts of the cell. The diffusion theory does not give satisfactory results for strongly absorbing rods. The properties of the rod are described by the product of the rod radius and the total macroscopic cross section a Σ_t and the number of secondary neutrons per collision γ. Using experimental results published by Cohen and Horowitz, a semiempirical method is developed for calculating the disadvantage factor for given a Σ_t and γ. A homogenization process is described so as to make it possible also to apply the method to heterogeneous cylindrical fuel elements. (auth)

15863 AEC-tr-3315

THE FAST FISSION EFFECT IN A CYLINDRICAL FUEL ELEMENT. (Beräkning av den Snabba Fissionsfaktorn för ett Cylindriskt Bränsleelement). I. Carlvik and B. Pershagen. Translated by Aase Vaslow (Oak Ridge National Lab.) from report AEF-70, Aktiebolaget Atomenergi, Stockholm, Nov. 24, 1956. 26p.

A new formula for the fast fission factor is derived, which takes proper account of fast capture. The fission neutron spectrum is divided into two groups with constant fission cross section in one group and zero fission cross section in the other. The average total, elastic, inelastic, and capture cross sections in the two groups are calculated. Different assumptions regarding anisotropic and inelastic scattering are investigated. The effects of backscattering from the moderator and fast fission in neighboring fuel elements are pointed out. Formulas for the fast fission ratio and for the fast conversion ratio are derived. The calculated fast fission ratios are compared with experimental values. Curves are given for the fast fission factor in uranium metal and uranium oxide. (auth)

15864 AEC-tr-3370

EFFECT OF A PERTURBATION IN THE REFLECTOR OF A PILE. CASE OF A RADIAL CHANNEL. (Effet d'une Perturbation dans le Reflecteur d'une Pile. Cas d'un Canal Radial). B. Lerouge and V. Raievski. Translated by Liz Appleby (Hanford Atomic Products Operation) from Report CEA-668, Nov. 1957. 15p.

Two-group theory is used to calculate the effects of absorption and transport in a channel placed in the reflector of a pile. The notations of H. L. McMurry are used with the matrix notations of Margenau and Murphy. (D.E.B.)

15865

DIVERGENCY DATA FOR HIFAR. C. N. Watson-Munro (Australian Atomic Energy Commission). Atomic Energy 7p.(1958) Mar.

Preparations for a zero energy divergency test are described, including cleaning, process testing, pressure testing, and drying the heavy water circuit. The analytical chemical techniques included analysis of the demineralized water used to clean the moderator circuit, and the isotopic purity of the heavy water. A description of start-up instrumentation is given, together with fuel loading and a discussion of divergency data. (J.R.D.)

15866

THE SODIUM GRAPHITE REACTOR. Chauncey Starr (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). Atomics and Nuclear Energy 9, 276-8(1958) Aug.

The sodium graphite reactor is a type which is under investigation in Britain with a view to development for power production. A description of American work on this type is given. (A.C.)

15867

DESIGN AND USE OF REACTOR SIMULATORS. E. H. Baer. Atomwirtschaft 3, 263-70(1958) July. (In German)

The advantages of the analog computer over the digital calculating machine as a reactor simulator are discussed. By use of a pressurized water reactor as an example the circuitry of a reactor simulator is shown. (J.S.R.)

15868

METALLURGICAL PROBLEMS OF NUCLEAR REACTORS. STRUCTURAL MATERIALS. Jean Bernard. Énergie nucléaire 2, 73-97(1958) Apr.-June. (In French)

After a survey of the specifically nuclear data of reactors, the different qualities, intrinsic and extrinsic, required for the structural materials of reactors are discussed. The effect of radiation on several aspects of their behavior is described. (tr-auth)

15869

FUEL ELEMENTS OF HETEROGENEOUS PILES WITH THERMAL NEUTRONS. Maurice Gauthron. Énergie nucléaire 2, 120-4(1958) Apr.-June. (In French)

The power of all actual reactors is limited by the behavior of their fuel elements. Such an element is composed of a fuel (uranium), in which fission releases heat, and a protective sheath between the fuel and the coolant. Different solutions are considered to assure the passage of the heat through the sheath. (tr-auth)

15870

THE SODIUM REACTOR EXPERIMENT. Energia nucleare (Milan) 5, 429-44(1958) July. (In Italian)

A description is given of the design and construction details of the Sodium Reactor Experiment. The SRE is

a graphite moderated reactor using slightly enriched uranium as fuel. It is cooled by liquid sodium and is designed to operate at 20,000 thermal kw. A parallel connected steam plant is provided to generate about 6,500 kw of electricity. (J.S.R.)

15871

CONTROL INSTALLATION OF THE BR 1 REACTOR. Charles Gérard and Jean Lhoir. Ind. Atom. 2, No. 7-8, 143-56(1958). (In French)

The article on the control of the BR 1 reactor is completed, and the section on the measurement circuits is continued. The command circuits, shut-down circuits, lock circuits, dosimetry circuits, and fault detection circuits are also described. The control room is sketched. (J.S.R.)

15872

APPLICATION OF TRANSISTORS TO SAFETY CIRCUITS. E. J. Wade and D. S. Davidson (General Electric Co., Schenectady, N. Y.). IRE Trans. Nuclear Sci. NS-5, 44-6(1958) Aug.

The application of transistors to circuits controlling the rod release for shutdown of a nuclear reactor is described. No vacuum tubes are used in the circuit. The circuits were designed with maximum attention to reliability and fail-safe operation. (auth)

15873

CAPACITANCE LEVEL GAUGE FOR PRESSURIZERS OF PRESSURIZED WATER REACTOR PLANTS. William Gernert (Westinghouse Electric Corp., Pittsburgh). IRE Trans. Nuclear Sci. NS-5, 50-3(1958) Aug.

The pressure of a pressurized water nuclear power plant is maintained by heating water to saturation temperature in a vessel partially filled with water. The water level in this vessel, the pressurizer, must be monitored for safe plant operation. The application of a well-known principle of liquid level measurement to this problem is described. The unusual operating conditions made the development of the device difficult. (auth)

15874

FAST TIME SCALE SIMULATION OF A REACTOR CONTROL SYSTEM. G. Friedensohn (Nuclear Development Corp. of America, White Plains, N. Y.) and D. H. Sheingold (George A. Philbrick Researches, Inc., Boston). IRE Trans. Nuclear Sci. NS-5, 53-63(1958) Aug.

The setup and results of a reactor kinetics and servosystem simulation is presented. The reactor, a 50-megawatt high flux materials and engineering test reactor designated Belgian Reactor-2, is controlled by means of a saturating servomechanism actuating a cadmium containing regulating rod. The simulation was set up on a 100/1 time scale using GAP/R high-speed analog computing equipment, and solutions were presented repetitively. Represented in the setup were six delayed neutron groups, variations in regulating rod effectiveness with displacement and reactor cycle time, four quadrant servomotor torque-speed characteristics, control rod position limiting, and a temperature coefficient of reactivity. The results presented include the response of the system to: reactivity disturbances, changes in desired power set point, increase of power on a constant period, and transition from manual to automatic control during startup. (auth)

15875

NRU REACTOR NEUTRON LEVEL CONTROL SYSTEM. C. G. Lennox and A. Pearson (Atomic Energy of Canada, Ltd., Chalk River, Ont.). IRE Trans. Nuclear Sci. NS-5, 64-7(1958) Aug.

A control system has been developed for the NRU reactor which performs automatic start-up as well as steady power control. The system characteristics and the circuits which determine them during start-up and under steady power control are described. (auth)

15876

THERMAL POWER CONTROL OF THE NRU REACTOR. C. G. Lennox and A. Pearson (Atomic Energy of Canada, Ltd., Chalk River, Ont.). IRE Trans. Nuclear Sci. NS-5, 68-72(1958) Aug.

When reactor power is controlled only by neutron leakage flux, a difficulty arises because the factor relating neutron flux level with reactor power is a function of the flux distribution in the reactor. Due to variation in control rod positions, the flux distribution will vary. A method for handling the problem by measuring the reactor thermal power and using this to adjust the power level demand circuits is presented. A stability analysis is also given. (auth)

15877

GCR2. THE ORNL DESIGN STUDY. Nuclear Eng. 3, 277-81(1958) July.

The main features of the enriched-uranium gas-cooled graphite-moderated reactor designed by ORNL are discussed. Some of the distinctive features are enriched uranium oxide fuel, helium cooling, stainless steel clad fuel elements, and a burnup of 7000 Mwd/t. The reactor is rated at 687 Mwh and 225 Mwe net. (W.D.M.)

15878

DESIGN PARAMETERS IN THE ORNL GAS-COOLED REACTOR STUDY. Nuclear Eng. 3, 282-5(1958) July.

The design parameters and economics of the enriched uranium oxide, stainless steel clad, helium-cooled reactor designed by ORNL are reviewed. (W.D.M.)

15879

THE EXPONENTIAL EXPERIMENT AT IMPERIAL COLLEGE. J. M. Kay and R. E. Strickland. Nuclear Eng. 3, 289-92(1958) July.

The necessity for a sub-critical assembly as an aid to reactor design is shown, and an account is given of design and construction of the natural uranium graphite-moderated assembly at Imperial College. (W.D.M.)

15880

NEPTUNE, THE ADMIRALTY ZERO ENERGY REACTOR AT HARWELL. J. Edwards and J. E. R. Holmes (Atomic Energy Research Establishment). Nuclear Eng. 3, 319-26(1958) Aug.

For the design of the "Dreadnought" submarine reactor, it was essential to have a zero-energy experimental unit for rapid checking of calculations. Some of the mechanical design features and the type of experimental work carried out are described. (auth)

15881

CERAMIC FUELS, PROPERTIES AND TECHNOLOGY. R. W. Nichols (U.K.A.E.A., Culcheth). Nuclear Eng. 3, 327-33(1958) Aug.

The properties and manufacture of the uranium oxides, carbides, and silicides for high-temperature reactors are discussed. (W.D.M.)

15882

POWER REACTORS IN CANADA. NPD AND CANDU STUDIES. Nuclear Eng. 3, 334-8(1958) Aug.

Design particulars and a description of the CANDU reactor a heavy water natural uranium oxide power reactor, are given. It has a net electrical capacity of 200 MW. (W.D.M.)

15883

HINKLEY POINT. THE WORLD'S REACTORS. NO. 19.

HINKLEY POINT POWER STATION. Nuclear Eng. 3, 286-6a(1958) July.

Details for the gas-cooled two-reactor Hinkley Point Power Station are given. A large schematic drawing of one of the reactor units is presented. (W.D.M.)

15884

ALUMINUM AND ITS ALLOYS. J. M. Bold (U.K.A.E.A., I. G., Culcheth Labs.). Nuclear Eng. 3, 296-302a(1958) July.

The application of aluminum and its alloys as canning materials for reactor fuel elements is considered, and the relevant physical, chemical, and mechanical properties are discussed.

15885

CHAPELCROSS POWER STATION. P. Knowles. Nuclear Power 3, 304-12(1958) July.

The Chapelcross nuclear power station will contain four 180 Mw gas-cooled, graphite-moderated reactors of the Calder Hall design and eight 23 Mw turboalternators. The primary purpose of the works is the production of plutonium but it will have a net electrical output of about 140 Mw. The differences in design between Chapelcross and Calder Hall are emphasized. A description of the site and the construction progress is given. (W.D.M.)

15886

REACTOR TEST LOOPS. 2. DESIGN FACTORS. A. T. Hooper (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Power 3, 318-22(1958) July.

The general procedure for the design of a major loop in DIDO and PLUTO and some problems of particular types now built or building are described. (W.D.M.)

15887

HEAT EXTRACTION IN POWER REACTORS. 2. G. Boxer (Birmingham Coll. of Tech., Eng.). Nuclear Power 3, 323-7(1958) July.

Heat transfer from fuel elements to coolant is reviewed. The salient features of heat extraction from a reactor core are summarized. Limitations on heat production and pumping rates are discussed. (W.D.M.)

15888

REACTOR TEST LOOPS. 3. TESTING AND COMMISSIONING. V. L. Fontaine (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Power 3, 354-8(1958) Aug.

The various checks that have to be made on in-pile loops from design studies to commissioning of the reactor are described. The organization of commissioning trials is detailed. (W.D.M.)

15889

FABRICATION PROBLEMS OF THE DOUNREAY FAST REACTOR. P. K. Richards (John Thompson Water Tube Boilers, Ltd.). Nuclear Power 3, 359-62(1958) Aug.

Requirements for the fabrication of the reactor vessel and cooling system are as follows: all internals must be degreased, free from dirt, and thoroughly dry; heat exchangers must be designed so that in the event of a leak occurring there is no possibility of water–sodium contact; oxygen-containing compounds within the vicinity of the sodium circuits must be kept to a minimum. (W.D.M.)

15890

U. S. EXHIBITS REACTOR WITH UNIQUE FUEL-MODERATOR. Nucleonics 16, No. 8, 116(1958) Aug.

The TRIGA, a training, research, and isotope-production reactor, is one of the operating reactors to be exhibited at the Geneva Conference by the AEC. The core of the reactor consists of aluminum-clad fuel elements which contain a homogeneous blend of fuel and moderator in the form of uranium–zirconium hydride. The characteristics and the isotope production facilities are described. (J.S.R.)

15891

U. S. DESIGNS GAS-COOLED REACTORS. Nucleonics 16, No. 8, 118-21(1958) Aug.

Design studies made by Kaiser Engineers with ACF Industries, Inc., as subcontractor and by ORNL on gas-cooled reactors are discussed. A summary is presented of the characteristics of the proposed AEC reactors and the United Kingdom and French reactors. (J.S.R.)

15892

Ag–In–Cd COULD REPLACE Hf FOR PWR CONTROL RODS. I. Cohen, E. F. Losco, and J. D. Eichenberg (Westinghouse Electric Corp., Pittsburgh). Nucleonics 16, No. 8, 122-7(1958) Aug.

The results of tests made on a silver–15 wt. % indium–5 wt. % cadmium alloy indicate that it could replace hafnium in control rods of future pressurized-water reactor cores. The effectiveness of the alloy for neutron capture is 99% that of Hf, and the decrease is small over the core life. It has good corrosion resistance. The alloy has sufficient yield strength to resist scramming loads of PWR control rods. There is no change in appearance and mechanical strength improves with irradiation. The melting, forging, extrusion, and machining are readily performed. The alloy would be preferable to hafnium because of greater availability and lower cost. (J.S.R.)

15893

GASEOUS-FUEL REACTOR. S. Baron (Burns and Roe, Inc., New York). Nucleonics 16, No. 8, 128, 130-3 (1958) Aug.

A reactor design utilizing gaseous UF_6 as the fuel is proposed. The reactor physics, engineering design, and fuel reprocessing for such a reactor is discussed. (J.S.R.)

15894

REACTORS ON THE LINE. ORR. Nucleonics 16, No. 8, 120a(1958) Aug.

The Oak Ridge Research Reactor is a light-water cooled and moderated reactor using 90% enriched uranium as fuel. A description of the reactor is given, and its characteristics are listed. (J.S.R.)

15895

ON THE MULTIGROUP CALCULATION METHOD FOR NUCLEAR REACTORS. G. I. Marchuk. pp. 7-21 in "Fizika i Teplotekhnika Reaktorov." Moscow, Publishing House on Atomic Power, 1958. 213p. (In Russian)

The multigroup method was applied in calculations of the fundamental and conjugate reactor equations. (R.V.J.)

15896

ANALYSIS OF THE RELATION BETWEEN CRITICAL MASS AND CRITICAL VOLUME FOR VARIOUS TYPE REACTORS. V. Ya. Pupko. pp. 44-56 in "Fizika i Teplotekhnika Reaktorov." Moscow, Publishing House on Atomic Power, 1958. 213p. (In Russian)

A qualitative analysis was made of the $G = f(v)$ function for given reactors with various possible fission material concentrations, and an attempt was made to predict the behavior of the function for reactors with fast and intermediate neutrons. (R.V.J.)

15897

EVALUATION OF HEAT RELEASING ELEMENTS OF VARIOUS FORMS. M. A. Zimin. pp. 149-163 in

"Fizika i Teplotekhnika Reaktorov." Moscow, Publishing House on Atomic Power, 1958. 213p. (In Russian)

Fuel rods and plates, tubular elements with unilateral cooling, multilayer tubular elements with bilateral cooling, Field's type tubes with unilateral cooling, and rods in channels and in packages distributed in a triangle lattice were evaluated. The rod and plate shaped fuel elements distributed in packages which permit a mean specific power extraction with sodium cooling of 1000 to 1500 kw/l (w = 9m/sec) are the most effective forms for fast reactors. All examined forms can be used for thermal reactors in the following order of efficiency: rods and plates, tubular elements with unilateral cooling, and elements of Field's type tubes. (R.V.J.)

15898

ANALYSIS OF OPTIMAL CONDITIONS FOR THERMODYNAMIC CYCLES IN ATOMIC POWER PLANTS. D. D. Kalafati. pp. 164-75 in "Fizika i Teplotekhnika Reaktorov." Moscow, Publishing House on Atomic Power, 1958. 213p. (In Russian)

15899

EFFECTIVE USE OF SATURATED STEAM IN ATOMIC POWER PLANTS. Yu. D. Arsen'ev. pp. 176-83 in "Fizika i Teplotekhnika Reaktorov." Moscow, Publishing House on Atomic Power, 1958. 213p. (In Russian)

Technological problems of the thermal cycle and the turbine construction for efficient utilization of saturated steam in atomic power plants are discussed. (R.V.J.)

15900

PROPERTIES OF THERMAL CYCLES FOR USE WITH BOILING HETEROGENEOUS REACTORS. Yu. D. Arsen'ev. pp. 184-97 in "Fizika i Teplotekhnika Reaktorov." Moscow, Publishing House on Atomic Power, 1958. 213p. (In Russian)

Factors affecting negative steam reactivity are studied. The scheme for a boiling reactor with natural and forced circulation is presented, and the fuel channel temperature and thermal load distributions are determined. Cycles with superheated steam and steam separation are evaluated, and the self-evaporation cycles are analyzed. (R.V.J.)

15901

ON THE THERMAL CYCLE OF NUCLEAR POWER PLANTS. D. P. Gokhshtein. pp. 198-204 in "Fizika i Teplotekhnika Reaktorov." Moscow, Publishing House on Atomic Power, 1958. 213p. (In Russian)

Thermodynamic analysis of nuclear power plant heat cycles indicated the effective use of low-boiling substances as working materials. Single and dual cycles can be designed depending on the initial conditions and the thermal stability of the material. The carbonic acid–helium system is suggested as a dual cycle approach. In some cases, the low-boiling primary coolant can be used also in the secondary system. In such instances, each system has its own offtake in the separator. (R.V.J.)

15902

RADIOACTIVE DEPOSITS IN THE WATER-STEAM LOOP OF NUCLEAR POWER PLANTS. Z. L. Miropol'skii. pp. 205-15 in "Fizika i Teplotekhnika Reaktorov." Moscow, Publishing House on Atomic Power, 1958. 213p. (In Russian)

The amount of radioactive admixtures in the water–steam loop and physical doses of irradiation near the equipment with radioactive deposition were evaluated. In large power plants with boiling reactors the radiation doses from the radioactive deposits near the turbine 24 hr after shutdown generally do not exceed permissible levels. However, in cases of fuel-element sheath damage, the dosage is considerably higher than the permitted standards. Measurements on an experimental boiling reactor showed that, depending on the pH of the water which varied from 5.8 to 8, the dose at the steamline was 0.43 to 0.12 r/hr; at the turbine inlet, 0.14 to 0.03 r/hr; at the turbine outlet, 0.05 to 0.015 r/hr; and at the bottom of condenser tank, 0.29 to 0.05 r/hr. The lower the pH, the larger the dose. Twelve hours after turbine shutdown the radiation intensity reduced 10 to 20 times. (R.V.J.)

15903

PHYSICS AND CALORIFICS OF REACTORS. Supplement No. 1 to "Atomnaya Energiya," 1958. Moscow, Publishing House on Atomic Power, 1958. 213p. (In Russian)

The supplement includes two groups of articles on reactor construction. The first group of articles deals with the physics, calculations, experiments, and safety problems. The other group of articles is dedicated to the engineering problems of calorific ratio in nuclear power reactors and heat-transfer cycles. The problems of effective off-take and utilization of heat produced in the active zone of power reactors and the problems of radioactive contamination of heat-transfer circuits from the reactors are also discussed. (R.V.J.)

15904

NUCLEAR REACTOR PLANT DATA. VOLUME ONE. POWER REACTORS. New York, The American Society of Mechanical Engineers, 1958. 66p. $3.00.

Information about the types of reactor plants and their experimental prototypes that are designed to produce electric power is presented. Both general information and specific technical data are presented for each plant on identical data sheets. (W.D.M.)

15905

REACTORS OF THE WORLD. FIRST SERIES. New York, Simmons-Boardman Publishing Corporation, 1958. 29p. $2.50.

Cutaway drawings and specifications are presented of the NRX, Bradwell-on-Sea, Dounreay, DIDO, Calder Hall, LIDO, ZEUS, DIMPLE, BEPO, the Russian 5 Mw power, the EBWR, and the CP5 reactors. (J.S.R.)

15906

POWER REACTOR TECHNOLOGY. Technical Progress Review, Vol. 1, No. 4. Dunedin, Fla., General Nuclear Engineering Corp., 1958. 66p. Available from U. S. Government Printing Office, Washington for $0.55.

Reactor Physics. Lattice measurements and analyses of slightly enriched U metal and UO_2 light-water moderated lattices are presented. An extensive set of buckling measurements on lattices in D_2O, made up of U metal plates, U rods, and UO_2 rods, all of natural enrichment, were made. Measurements of the lattice parameters for the natural-uranium graphite-moderated water-cooled lattices are reported. A series of measurements of the effective resonance integral in U metal and UO_2 has been reported. Heat Transfer. A discussion of transition boiling and burnout is presented. Reactor Dynamics and Safety. A discussion is presented on the stability of boiling-water reactors. The discussion is based on results of Borax experiments and recently published papers dealing with the stability of boiling-water reactors. A discussion is presented of fission-product release from molten reactor fuel. The contain-

ment of fission products after a reactor accident involving a substantial energy release is presented. Fuel Cycles. The isotope build-up in recycled-fuel and the re-enrichment by blending of recycled fuel are discussed. Fuel Elements. Some properties are presented for unalloyed UO_2 and canning or clad materials. Properties of fuel elements used in electric power reactors cooled by CO_2 are presented. General characteristics of UO_2-type elements used in water-cooled reactors, uranium metal type elements used in water-cooled reactors, uranium metal type elements used in CO_2-cooled reactors, UO_2 type elements used in gas-cooled reactors, and uranium metal alloy elements used in sodium-cooled reactors are presented. Radiation Damage to Other Reactor Materials. A brief review is given of the data that are available on the effects of radiation damage to materials that may be used in or around the reactor. Progress on Specific Reactor Types. The general characteristics of the Organic Moderated Reactor Experiment and a summary and discussion of the significant results of limited operation are presented. Discussions are also presented on the boiling-water reactors, gas-cooled graphite-moderated power reactors, D_2O-moderated reactors, and test reactors. (W.L.H.)

Nuclear Transformation

15907 NP-6901

Joint Inst. for Nuclear Research, Moscow. Lab. of Nuclear Problems.

TRITIUM PRODUCTION BY 120–660 MEV PROTONS IN METALS. V. V. Kuznetsov and V. N. Mekhedov. 1958. 15p.

The results of the investigation of tritium production in different elements at the proton energy 660 Mev are presented. The excitation functions for the reactions of tritium production in aluminum and lead in the energy region 120 to 660 Mev are given. (auth)

15908 UCRL-8324

California. Univ., Berkeley. Radiation Lab.

HIGH-ENERGY BETA DECAY OF LIGHT ELEMENTS (thesis). James F. Vedder. June 16, 1958. 87p. Contract W-7405-eng-48. $2.25(OTS).

The beta decay of the radioactive members of the mass-eight and -twelve triads has been studied with a spiral-orbit spectrometer having a 1.3% resolution. The end point, half-life and log-ft values, respectively, are: for N^{12}, 16.37 ± 0.06 Mev, 11.43 ± 0.05 milliseconds, and 4.17; for B^{12}, 13.40 ± 0.05 Mev, 20.6 ± 0.2 msec and 4.11; for B^8, 14 Mev (broad), 0.75 ± 0.02 sec, and 5.72; and for Li^8, 13 Mev (broad), 0.87 ± 0.01 sec, and 5.67. The mass excesses in millimass units are: for N^{12}, 22.48 ± 0.06; for B^{12}, 18.19 ± 0.06; for B^8, 27.08 ± 0.13; and for Li^8, 24.97 ± 0.09. The shapes of the Kurie function for the mirror pairs indicate positron and electron transitions to the same levels of the daughter nuclide, with greater percentages in the positron branches relative to the ground-state transitions because of the higher energy available. The Li^8 and B^8 shapes are consistent with the shape of the alpha spectrum following the decay of the Be^8 daughter. Less than 1% of the Li^8 transition and less than 5% of the B^8 transition go to the Be^8 ground state. Besides the main transition to the broad 2.9-Mev level, a broad level near 11 Mev is probably involved. The ft values and the assumption of J = 0, 2, and 4 levels in Be^8 favor J = 3 for Li^8 and B^8. The N^{12} and B^{12} spectra indicate transitions of a few percent to the 4.43- and 7.65-Mev levels in C^{12}, with higher levels not excluded. For these nuclides J = 1 is favored. The agreement of the measured end points and resulting Q values with published values shows that the spiral-orbit spectrometer can be accurately calibrated with only the theory as a guide. Another evaluation of the spectrometer is that the measured shape of the B^{12} Kurie function is the same within statistics as that obtained elsewhere with a ring-focus magnetic-lens spectrometer. (auth)

15909 UCRL-8330

California. Univ., Berkeley. Radiation Lab.

SURVEY OF TRITIUM-PRODUCING NUCLEAR REACTIONS (thesis). José González-Vidal. June 1958. 64p. Contract W-7405-eng-48. $1.25(OTS).

Reactions (p,t), (d,t), and (α,t) have been investigated throughout the periodic table by bombarding stacked metal foils and determining directly the tritium produced in the reaction. In the (α,t) reactions, there is conclusive evidence that most of the tritons are produced with high energies, thus indicating the presence of direct interaction processes. The curve representing the integrated cross-section vs. Z of the target rises with decreasing Z; this, and the appearance of low-energy peaks in the individual excitation functions of low-Z targets indicate that at low and intermediate values of Z the relative number of low-energy tritons increases. These tritons are indicated to be the product of a compound-nucleus mechanism. For the (p,t) and (d,t) reactions the same compound-nucleus and direct-interaction effects are noticed. The angular distributions of tritons from $Al^{27}(\alpha,t)Si^{28}$ and $Fe^{56}(\alpha,t)Co^{57}$ have been studied. It has been found that these angular distributions can be fitted by Butler's theory. The integrated differential cross-sections from these distributions account for a large portion of the cross-sections as determined by the stacked-foil technique. (auth)

15910 UCRL-8347

California. Univ., Berkeley. Radiation Lab.

NUCLEAR REACTION MECHANISMS IN THE HEAVY-ELEMENT REGION (thesis). Paul F. Donovan. June 1958. 57p. Contract W-7405-eng-48. $1.75(OTS).

Angular distributions of the heavy recoils produced in the (α,2n), (α,3n), (α,4n), (α,t), (d,n), (d,2n), (d,3n), and (d,p) reactions of Bi^{209} have been measured at various incident-particle energies. The mechanisms of the (α,2n), (α,3n), and (d,3n) reactions have been interpreted by comparison of these angular distributions with theoretical angular distributions resulting from Monte Carlo calculations based on a simple evaporation model. Further information concerning the reaction mechanisms of the (α,2n), (α,3n), and (α,4n) reactions is derived from the results of experimental recoil range measurements. Probable mechanisms are suggested for several of the other reactions. (auth)

15911 UCRL-8357

California. Univ., Berkeley. Radiation Lab.

THE DEUTERON-PICKUP REACTION IN AN OPTICAL-MODEL APPROXIMATION (thesis). Kenneth R. Greider. July 7, 1958. 72p. Contract W-7405-eng-48. $2.00(OTS).

A theory of the (p,d) pickup reaction is described, in which the nuclear interactions of the incoming and outgoing particles are considered. Two different formal expressions that give the transition amplitude are derived, and the wave functions in this amplitude are approximated by an optical-model procedure in which it is assumed that the initial- and final-state particles

scatter elastically in the nucleus. The inelastic-scattering effects are shown to be small. Several closed forms for these optical-model wave functions are derived on the basis of a WKB approximation for a complex square-well scattering potential. The use of these wave functions, along with an approximation that gives the form of the transition amplitude in terms of Gaussian functions, allows a closed-form solution for the differential cross section. It is found that the elastic scattering processes are not negligible, since they affect considerably the magnitude and the shape of the differential cross section. By comparing the theory with recent pickup experiments on C^{12} at 95 and 145 Mev, one obtains a nuclear-momentum distribution that, unlike the Born approximation analysis, is in good agreement with the results of other determinations of momentum distributions. It is found that a neutron number of from 4 to 7 neutrons and a momentum distribution of $\exp(-E/20)$ are required to fit the data. The polarization effects in the pickup process are investigated by using spin-orbit potentials in addition to the central potentials to describe the initial- and final-state scatterings. Simple forms for the spin orbit, elastic scattering wave functions are developed, so that the transition matrix can be obtained without difficulty in closed form. The usual polarization formalism is applied to obtain the asymmetry of deuterons produced by initially polarized protons, and the results compare favorably with recent experimental data. (auth)

15912

THE REACTION $Mg^{25}(p,\gamma)Al^{26}$. J. C. Bizot, Francoise Muller, and G. R. Bishop (École Normale Supérieure). J. phys. radium 19, 571-2(1958) May. (In French)

The gamma spectra formed by the reactions $Mg^{25}(p,\gamma)Al^{26}$ and $Mg^{25}(p,p',\gamma)Mg^{25}$ were studied using bombarding energies between 0.985 and 2 Mev. The excitation curve for $Mg^{25}(p,\gamma)Al^{26}$ is given. The gamma rays were assigned to one of the two reactions. Mg^{25} in the (p,p',γ) reaction is left either in its first or its second excited state. The resonance at 1.105 Mev is interpreted by the assumption of a 5.16-Mev level which disintegrates by transitions to the 2.06-, 2.07-, and 3.16-Mev levels. A level at 2.39 Mev is suggested which is assigned a negative parity, a 2 or 3 spin, and an isotopic spin T = 0. (J.S.R.)

15913

CALCULATION OF THE $O^{16}(d,p)O^{17}$ ANGULAR DISTRIBUTION. John L. Richter and Eugene V. Ivash (Univ. of Texas, Austin). Phys. Rev. 111, 245-9(1958) July 1.

Results of calculations based on the Tobocman theory are presented for the angular distribution of the outgoing protons produced by the $O^{16}(d,p)O^{17}$ stripping reaction in which the residual nucleus is left either in the ground state or in the first excited state, and for incident energies well below the Coulomb barrier. A variety of nuclear models are examined, including the optical model, and the theoretical distributions compared with experimental ones. (auth)

15914

REACTION MECHANISM IN $F^{19}(\alpha,p)Ne^{22}$ AT 6 Mev. G. F. Pieper and N. P. Heydenburg (Carnegie Inst. of Washington). Phys. Rev. 111, 264-71(1958) July 1.

Angular distributions of protons corresponding to the ground-state and first excited-state transitions in the reaction $F^{19}(\alpha,p)Ne^{22}$ have been measured for five bombarding energies in the region of 6.0 to 6.55 Mev. Angular correlations of the de-excitation gamma ray from the first excited state of Ne^{22} with the alpha-particle and proton directions have been measured for six different combinations of bombarding energy and proton detection direction. Some, but not all, of the results show striking agreements with predictions based on simple direct-interaction mechanisms. (auth)

15915

NOTE ON THE COLLISION MATRIX FOR THE NUCLEAR REACTIONS. I. Mitsuji Kawai (Univ. of Tokyo) and Masayuki Nagasaki (Tokyo Univ. of Education). Progr. Theoret. Phys. (Kyoto) 19, 77-92(1958) Jan.

The relation between the general theory of nuclear reactions due to Kapur and Peierls and that due to Wigner and Eisenbud is discussed. It is shown that the exact transformation of the R-matrix into the collision matrix yields the expression for the latter which is identical term by term with that obtained by Kapur and Peierls. The intuitive interpretation of the transformation procedure is given in terms of the "multiple re-reflection interpretation." (auth)

15916

THE (β,γ) CIRCULAR POLARIZATION CORRELATION FOR Sc^{46}. W. Jüngst and H. Schopper (Physikalischen Institut, Erlangen, Germany and Institut fur Kernphysik, Mainz). Z. Naturforsch. 13a, 505-7(1958) July. (In German)

The (β,γ) circular polarization correlation for the mixed β transition of Sc^{46} was measured as a function of electron energy. An asymmetry coefficient $A = +0.24 \pm 0.04$ was found which is somewhat lower than that given by other authors. Thus, no conclusion about time reversal invariance can be drawn. However, the ratio of matrix elements and their relative phase was determined. (auth)

Particle Accelerators

15917 CERN-58-14

European Organization for Nuclear Research, Geneva. THE TRANSPORT CARRIAGES FOR THE PS MAGNET UNITS. A. H. Achermann. July 1958. 36p.

The design features of the transport carriage and track layout for placement of the 40-ton magnet units of a proton synchrotron are shown and discussed. A fixed circular track with turntables, switches and an entry ramp is described. Detailed drawings of track, carriage, and controls are given. (T.R.H.)

15918 MURA-412

Midwestern Universities Research Assn., Madison, Wis. AN FFAG ACCELERATOR FOR ACHIEVING 9 BEV CENTER-OF-MASS COLLISIONS BETWEEN ELECTRONS AND PROTONS. Lawrence W. Jones. July 7, 1958. 7p. Contract AT(11-1)-384. $1.80(ph OTS); $1.80(mf OTS).

The possibility of an electron-proton colliding-beam spiral sector FFAG accelerator is explored. A single 10,000 ton magnet structure with r-f systems for both protons and electrons could be used for accelerating and stacking 5-Bev electrons and 4-Bev protons circulating in opposite directions. The expected electron-proton interaction rate is 10^6 less per centimeter than could be achieved with a 45-Bev electron linear accelerator and a liquid hydrogen target. The limit on electron current is set by the practical power which must be supplied to make up radiation losses, and on proton current density by space charge forces. (auth)

15919
LINEAR ELECTRON ACCELERATORS. Pierre Grivet and Marcel Pillon. Ind. Atom. 2, No. 7-8, 65-77(1958). (In French)

A review is presented on linear electron accelerators, covering the theory, construction of wave guides, calibration of the guides, sources of UHF power with particular emphasis on klystron tubes, optical properties of the electron bundle, and use of the linear accelerator. 12 references. (J.S.R.)

15920
STRONG-FOCUSING LENSES. Albert Septier. Ind. Atom. 2, No. 7-8, 79-90(1958). (In French)

The development of high-energy particle accelerators required the development of a lens to channel the rays for a great distance, to concentrate the particles on targets or to the entrance of an analyzer, and to focus the beam during the process of acceleration. After showing that the classical lens is insufficient to perform this tasks, the theoretical properties of strong-focusing lenses are discussed and the experimental study to attain them is described. Possible applications of strong-focusing lenses are reviewed. 20 references. (J.S.R.)

15921
STUDY OF ANHARMONIC OSCILLATIONS BY MEANS OF AN ELECTROMECHANICAL ANALOG. Marcel Barbier (CERN, Geneva). Ind. Atom. 2, No. 7-8, 109-12(1958). (In French)

The betatron oscillations in accelerators were studied by the use of an electromechanical analog, which has two degrees of freedom susceptible to being excited as a function of place or of time. The design of the analog is described, and sample results obtained with it are presented. (J.S.R.)

15922
7-BEV HIGH-INTENSITY PROTON SYNCHROTRON. Jacqueline Juillard-Feyler. Ind. Atom. 2, No. 7-8, 133-4(1958). (In French)

The specifications of the British 7-bev proton synchrotron which is being constructed at Harwell are given. (J.S.R.)

15923
A BEAM-SCANNED ROTATING HEAVY-ICE TARGET FOR HIGH LOADS. J. H. Spaa (Philips Research Labs., Eindhoven, Netherlands). J. Sci. Instr. 35, 175-8(1958) May.

From the several possible targets for the $D(d,n)He^3$ reaction the heavy-ice target proves to be the most suitable for outputs of about 10^{10} neutrons per second. Beam scanning in two perpendicular directions combined with rotation of the target is found to be necessary to secure a sufficient life of the ice surface. (auth)

15924
A COMMERCIAL IRRADIATION SERVICE. New MV Laboratory Formally Opened. Nuclear Eng. 3, 294-5 (1958) July.

The irradiation source of the new Metropolitan–Vickers laboratory is a 4-Mev linear electron accelerator. It is compared with β and γ emitting isotopes and fission product sources. (W.D.M.)

15925
UP TO DATE PROBLEMS ON ACCELERATION OF ATOMIC PARTICLES. V. I. Veksler. Vestnik Akad. Nauk S.S.S.R. 28, 32-43(1958) May. (In Russian)

A review is given of the development of particle accelerators and their applications in nuclear research. (R.V.J.)

15926
ACCELERATORS WITH RADIALLY-GROWING LEADING FIELD AND ADDITIONAL ELECTRON-OPTICAL ELEMENTS FOR VERTICAL FOCUSSING OF THE BEAM. V. M. Kelman, B. P. Peregud, and K. A. Dolmatova (Inst. of Physics and Tech., Leningrad). Zhur. Tekh. Fiz. 28, 1056-64(1958) May. (In Russian)

A method is offered for focusing the particle beam in accelerators with radially growing leading fields. The focusing is achieved by additional cylindrical magnetic lenses or magnetic apertures. The method secures radial and vertical betatron oscillations and can be used in various types of cyclotrons. Construction of various focusing systems is discussed, and design of an electron model is included. (R.V.J.)

15927
INVESTIGATION OF THE PARTICLE MOTION IN ACCELERATORS WITH A RADIALLY-GROWING FIELD AND ADDITIONAL SYSTEMS FOR FOCUSSING OF THE PARTICLE BEAM. Yu. V. Vandakurov (Inst. of Physics and Tech., Leningrad). Zhur. Tekh. Fiz. 28, 1065-76(1958) May. (In Russian)

Studies were made of particle beam motion in accelerators with a field which can be described as total of two fields, one symmetric to the axis of the leading field and periodically dependent on the azimuthal field and the other created by various systems of conductors with currents. In one of the investigated cases the field is of the normal type with alternating azimuthal gradient. Trajectories of particles with constant energies were studied by linear approximation, and conditions were found in which the motion is stable. The relation describing the magnitude of minimum power necessary for securing stable motion was found. (R.V.J.)

15928
BEAMS OF DIFFERENT MASSES IN ELECTROSTATIC ACCELERATORS. S. L. Andersen, K. Gjötterud, T. Hoitebekk, and O. Lönsjö (Univ. of Oslo, Blindern). Nuclear Phys. 7, 384-8(1958) July (1).

The use of the H_2^+ beam to obtain yield curves for (p,γ) reactions is shown to introduce an additional energy spread of about 0.5 kev at 500 kev proton energy. A simple explanation for this effect is suggested. It is also found that the use of the H_2^+ beam leads to lower values for the resonance energies. Resonance energies and upper limits for the half-widths are given for three resonances in the Al^{27} (p,γ) Si^{28} reaction. (auth)

Radiation Absorption and Scattering

15929 NP-6908
Joint Inst. for Nuclear Research, Moscow. Lab. of Theoretical Physics and Joint Inst. for Nuclear Research, Moscow. Lab. of Nuclear Problems.
PHENOMENOLOGICAL ANALYSIS OF REACTIONS OF THE $\alpha + \alpha' \rightarrow \beta + \beta'$ TYPE. S. M. Bilen'skii (Bilenky), L. L. Lapidus, L. D. Puzikov, and R. M. Ryndin. 1958. 16p.

Conditions for reconstruction from experimental data of the matrix for reactions of the $\alpha + \alpha' \rightarrow \beta + \beta'$ type are considered on the basis of general quantum mechanical principles. The reaction matrix M is expanded in a complete set of irreducible tensor operators $T^{JM}(j_\beta, j_\alpha)$, and the number of complex scalar functions which determine it is computed for the case when invariance under space rotations and reflections is taken into account. Time-reversal invariance of the interac-

tion leads to relations between polarization effects in the direct and inverse reactions. The number of experiments required for complete reconstruction of the reaction matrix in the presence of several channels can be determined on basis of unitarity of the S matrix. The general form of the azimuthal dependence of the angular distribution of the reaction products (for arbitrary spins) is derived in the appendix. (auth)

15930 NP-6923

Lockheed Nuclear Products, Marietta, Ga.
GAMMA REMOVAL DOSE CALCULATIONS. Walter R. Burrus. July 1958. 33p. (NR-32).

It is shown how to relate the absorbed dose in one sample to the absorbed dose in another sample. For low-atomic-number materials the Compton contribution to the absorbed dose is more important than either the photoelectric or pair-production contribution. The average Compton cross section per electron must be known to determine the energy flux; but it is not required to find the dose in one material from the dose in another. Even so, the average cross section is not sensitive to the shape of the gamma spectrum, since the Compton energy absorption cross section varies less than 20% from 80 kev to 4 Mev. For heavier material the photoelectric contribution to absorbed dose may become important. The average photoelectric cross section depends greatly on the spectrum of the radiation. The pair-production contribution is important with respect to the Compton contribution only for relatively heavy materials. Even so, it may be negligible as compared to the photoelectric contribution. (auth)

15931 NYO-8669

New York Univ., New York. Atomic Energy Commission Computing and Applied Mathematics Center.
COMPUTATION OF THE TRANSPORT COEFFICIENTS USING THE SHIELDED COULOMB POTENTIAL. Richard L. Liboff. June 20, 1958. 28p. Contract AT (30-1)-1480. $6.30(ph OTS); $3.00(mf OTS).

In the classical Chapman-Enskog theory of a fully ionized gas, the transport coefficients evolve as functions of certain weighted total scattering cross-sections. If a Coulomb potential is assumed between scattering particles, these scattering integrals diverge. A common procedure to circumvent this difficulty is to integrate the Coulomb results up to the Debye cut-off. A more appropriate procedure involves the use of the shielded Coulomb potential, in which case the scattering integrals converge, and there is no need to introduce a cut-off. These integrals are calculated using the shielded Coulomb potential and the results are compared with those of the standard "Coulomb plus Debye cut-off" calculations. To the "dominant log term" the two procedures give identical results. To terms of the next order of accuracy the difference is seen to remain small. (auth)

15932

GAMMA-RADIATION ABSORPTION COEFFICIENTS OF AIR IN THE ENERGY RANGE 0.01 TO 100 Mev. J. W. Allison (Australian Defence Scientific Service, Melbourne). J. Appl. Phys. 29, 1175-8(1958) Aug.

Two simple formulas are given which enable the total mass absorption coefficient of air to be readily calculated. These formulas, which are derived from published theoretical values of the total coefficient, are applicable to the energy ranges 0.01 to 100 Mev and 0.05 to 10 Mev, and yield results which agree with the theoretical values to within about 5% and 1%, respectively. Comparison is made with values calculated from existing empirical formulas which cover energies up to about 1 Mev. (auth)

15933

EXPERIMENT DESIGNED TO SHOW THE DELBRUCK EFFECT IN THE ELASTIC SCATTERING OF 2.62 Mev PHOTONS. Philippe Eberhard, Lazare Goldzahl, and Eiichi Hara (Collège de France, Paris). J. phys. radium 19, 658-67(1958) July. (In French)

Elastic scattering measurements were performed for γ rays in order to find a proof of Delbruck scattering. Measurements are described for 2.62-Mev γ rays from Th C'' and scatterers of lead, bismuth, and uranium. The cross sections of elastic scattering have been found with an accuracy 15 to 20%. (tr-auth)

15934

ELASTIC SCATTERING BY LEAD AND TIN OF 1.33 AND 1.17 Mev γ RAYS FROM Co^{60} AND 1.12 Mev γ RAYS FROM Zn^{65}. E. Hara, J. Banaigs, P. Eberhard, and L. Goldzahl (Collège de France, Paris). J. phys. radium 19, 668-73(1958) July. (In French)

Total elastic scattering is measured for 1.12, 1.17, and 1.33 Mev γ rays and compared with new theoretical calculations. No effect of Delbrück scattering is found, but an inelastic scattering appears, which had been neglected until now. (tr-auth)

15935

EVIDENCE OF THE INELASTIC SCATTERING OF γ RAYS BY ELECTRONS BOUND TO THE ATOM. L. Goldzahl and J. Banaigs (Collège de France, Paris). J. phys. radium 19, 678-80(1958) July. (In French)

To show the inelastic scattering of gamma rays by bound electrons, the 1.12-Mev γ rays of Zn^{65} were scattered under 50° by lead up to 0.9 Mev or in a band of 20% of the total length of the spectrum. The results are graphed, and it is seen that with an angular resolution of 8° there are as many photons scattered inelastically between 1.12 and 0.9 Mev as are scattered elastically. (J.S.R.)

15936

RELATION OF SCATTERING PHASES TO INTERACTION PARAMETERS. E. Van Der Spuy and H. J. Pienaar (Univ., Stellenbosch). Nuclear Phys. 7, 389-96(1958) July (1).

An analysis is introduced which relates the parameters of suitable functions of experimental scattering phases, in the presence of Coulomb forces, to parameters which define the nuclear interaction. A feature of the analysis is to circumvent the need for the troublesome continuous bivariate interpolation of Coulomb-functions, and requires instead the knowledge of a number of coefficients which are functions of one nuclear parameter which assumes only certain discrete values, corresponding to nuclear quantities (such as charge, reduced mass, and outer nuclear radius) which need in practice be tried only at discrete values. A further advantage of the analysis is the direct relation which it establishes between experimental phase parameters and the nuclear interaction parameters. (auth)

15937

THE INTERACTION OF TWO ALPHA-PARTICLES. E. Van Der Spuy and H. J. Pienaar (Univ., Stellenbosch). Nuclear Phys. 7, 397-410(1958) July (1).

It is investigated whether the phase shift data for alpha-alpha scattering up to bombardment energies ≈ 6 Mev can be represented by a velocity-independent alpha-alpha interaction potential, or a two-body interaction. It is found on the basis of square well potentials and of a general purely phenomenological analysis,

which is here developed for interactions with an infinite repulsive core, that this is not possible even for this low energy domain. The results indicate, however, that an outer interaction radius $\approx 4 \times 10^{-13}$ cm with a strong repulsive core of radius $\approx 1.8 \times 10^{-13}$ cm is required. These dimensions are in line with fundamental group resonance calculations of the alpha-alpha interaction starting from nucleon-nucleon forces, which also indicated that the repulsive core of the interaction is velocity-dependent. This velocity-dependence may, for example, be phenomenologically indicated by a lower effective repulsive core radius for higher l. (auth)

15938

ON THE SOLUTIONS OF THE LOW SCATTERING EQUATION IN A SIMPLE MODEL. F. Duimio (Univ. of Milan and Istituto Nazionale di Fisica Nucleare, Milan). Nuovo cimento (10) 8, 826-33(1958) June 16.

It is shown that for the Low scattering equation associated to a simple model proposed by Dyson, a unique solution can be found, when a complete set of physical parameters is known. These parameters consist of the energy levels and of the renormalized coupling constants of the true bound states which explicitly appear in the Low equation, supplemented by the analogous quantities for the possible unstable states. (auth)

15939

REMARKS ON A MODEL FOR S-WAVE MESON-NUCLEON SCATTERING. T. Kobayashi and A. Klein (Univ. of Pennsylvania, Philadelphia). Nuovo cimento (10) 8, 850-5(1958) June 16.

In a recent paper by Lomon, an attempt was made to produce an exact solution of the field theoretic model for S-wave meson-nucleon scattering in which the interaction is the sum of a scalar pair term and of an isotopic spin-orbit coupling. The solution in question is shown to be exact only in the classical limit, i.e., to correspond to the linear or one-meson approximation. It is also shown that the attempt to take the point source limit of the renormalization encounters difficulties similar to those found in the Lee model and in the simple pair theory. (auth)

15940

THE NATURE OF THE TAPER TRACKS OF HEAVY IONS IN NUCLEAR EMULSIONS. O. Skjeggestad (Univ. of Oslo, Blindern, Norway). Nuovo cimento (10) 8, 927-35(1958) June 16.

The thinning down of the tracks of heavy ions as they approach the end of their range in electron sensitive photographic emulsion can be quantitatively explained on the assumption that the thickness of the developed track is due mainly to δ-rays which no longer have sufficient range at low ion velocities to broaden the track. (auth)

15941

ANNIHILATION OF POSITRONS IN ORGANIC COMPOUNDS. Charles R. Hatcher, W. E. Millett, and Louis Brown (Univ. of Texas, Austin). Phys. Rev. 111, 12-15(1958) July 1.

The mean life τ_2 and the fraction I_2 of positrons which decay with a "long" 10^{-9}-sec lifetime have been measured in several organic compounds, most of which are derivatives of benzene. For the long components observed in liquids τ_2 ranges from 1.6×10^{-9} sec to 2.5×10^{-9} sec, whereas I_2 varies from 35% to 4%. A correlation between I_2 and certain properties of the molecules indicates a qualitative explanation of the results. (auth)

15942

PROTON-PROTON SCATTERING AT 40 Mev. L. H. Johnston and D. A. Swenson (Univ. of Minnesota, Minneapolis). Phys. Rev. 111, 212-22(1958) July 1.

Differential cross sections have been measured for the scattering of 39.4-Mev protons by hydrogen gas at angles from 45° to 4° in the laboratory system, with ±½° angular resolution at small angles. Data are given for every half degree near the interference minimum. The relative and absolute probable errors given are respectively ±0.5% and ±0.8% from 45° to 8°. The corresponding probable errors at 4° are ±4.0% and ±4.1%. The cross-section curve is essentially flat at 11.15 millibarns from 90° to 55° in the center-of-mass system. It falls to a minimum of 9.80 millibarns at 21°, and rises rapidly to 104 millibarns at 8°. A typical but not unique set of phase shifts which fit the data is: $^1S_0$, 40°; $^3P_0$, 16.90°, $^3P_1$, −6.93°; $^3P_2$, 3.04°; $^1D_2$, 2.16°; coupling parameter between $^3P_2$ and $^3F_2$ as defined by Stapp, −2.21°. (auth)

15943

ANALYSIS OF 40-Mev p-p SCATTERING. H. Pierre Noyes and Malcolm H. MacGregor (Univ. of California, Livermore). Phys. Rev. 111. 223-7(1958) July 1.

Analysis of the 40-Mev p-p scattering data of Johnston and Swenson shows that either the singlet proton-proton interaction gives an anomalously large D wave and an anomalously small S wave at 40 Mev, or that angular momentum states in addition to S, P, and D are present. The anomalously small S-wave fits to the data are always accompanied by large polarizations unless F waves are present as well. Hence, recent experimental measurements at Harvard, which show that the p-p polarization at 40 Mev is small, rule out the possibility of fitting the data with only S, P, and D waves. (auth)

15944

SCATTERING OF 14.5 Mev NEUTRONS BY COMPLEX NUCLEI. J. H. Coon, R. W. Davis, H. E. Felthauser, and D. B. Nicodemus (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 111, 250-60(1958) July 1.

New measurements of the differential elastic scattering cross sections of C, Al, Fe, Cu, Sn, Pb, and U for 14.5-Mev neutrons are reported. For Fe, Cu, Sn, and Pb the angular range from 5° to 150° was investigated with ±1° to ±3° angular resolution. For the other elements a smaller angular range was investigated. Particular effort was devoted to the problem of discriminating against inelastically scattered neutrons and methods were developed which provided an experimental energy resolution of ~500 kev. Limited differential cross section data for inelastically scattered neutrons of energy greater than 9 Mev are also presented for Fe, Cu, Sn, and Pb. (auth)

15945

ELASTIC SCATTERING OF ALPHA PARTICLES BY CARBON-14. James A. Weinman and Edward A. Silverstein (Univ. of Wisconsin, Madison). Phys. Rev. 111, 277-83(1958) July 1.

The elastic scattering of alpha particles by C^{14} has been observed for alpha energies between 2.0 and 3.9 Mev and for $\theta_{c.m.}$ = 169°, 149.5°, 140.8°, 125.3°, and 90°. The solid targets of 38.6% C^{14} were at least 8 kev thick. Energies of both the incident and scattered particles were measured with cylindrical electrostatic analyzers. The off-resonance cross sections were normalized to those derived from dispersion theory. Dispersion formalism applied to $C^{14}(\alpha,\alpha)C^{14}$ and $C^{14}(\alpha,n)O^{17}$ data yields the resonance energies, angular momenta, parities, and reduced widths of several O^{18} levels. The levels of O^{18} considered had

the following resonant energies, parities, and J values: 8.051 Mev (0^+ or 1^-), 8.222 Mev (2^+), 8.293 Mev (3^-), 8.966 Mev ($\geq 2^+$), and 9.0 to 9.2 Mev two levels, either (2^+3^-) or (4^+3^-). (auth)

15946

SCATTERING OF 220-Mev POLARIZED PROTONS BY COMPLEX NUCLEI. E. M. Hafner (Univ. of Rochester, N. Y.). Phys. Rev. 111, 297-312(1958) July 1.

Extending earlier measurements, yields and asymmetries in the scattering of a highly polarized proton beam by Be^9, C^{12}, Al^{27}, and Ca^{40} were studied. In the work on Be^9 and Al^{27}, the beam was monochromatized through the use of a regenerative deflector; its mean energy on striking the targets was 219.6 Mev, and its standard deviation in energy (including the effect of short time fluctuations) was less than 1.1 Mev. With this technique, together with a refined procedure for the analysis of the distribution in range of scattered protons, separation of elastic from inelastic scattering in Be^9 at angles from 8° to 37.5° was accomplished, and the inelastic scattering involving the excited state at 2.4 Mev was estimated. The separation of elastic scattering in Ca^{40} could also be made, although the regenerator was not used. The results are compared with approximate calculations based on the optical model with $\sigma \cdot L$ coupling; a potential is found such that, with variation of the nuclear radius alone, good fits are obtained to measurements on the four nuclei. (auth)

15947

ENERGY-MOMENTUM RELATION IN LIQUID HELIUM BY INELASTIC SCATTERING OF NEUTRONS. D. G. Henshaw (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Phys. Rev. Letters 1, 127-9(1958) Aug. 15.

The wavelength change of neutrons scattered inelastically from liquid helium at several temperatures was measured at angles of scattering of 45.4, 90, 35, and 80°. At the lowest liquid temperatures, the broadening due to the liquid helium is <0.5°K. At the lowest liquid temperature there is a well defined change in wavelength of the scattered neutrons. The corresponding changes in energy and momentum of the scattered neutrons were calculated for each angle. (W.D.M.)

15948

THE DISPERSION RELATIONS FOR THE SCATTERING OF PHOTONS FROM PROTON. Tomoya Akiba and Iwao Sato (Tohoku Univ., Sendai, Japan). Progr. Theoret. Phys. (Kyoto) 19, 93-111(1958) Jan.

The dispersion relations are derived for the non-forward amplitudes for photon-proton scattering. By expanding these relations in momentum transfer and retaining first few terms, the dispersion relations for six independent combinations of the partial wave amplitudes are obtained. Contributions of the nonphysical region are calculated to the first order in the fine structure constant, and are found to be consistent with the low-energy theorem. Using these relations and photopion production data, the differential cross sections are calculated. In doing this, the amplitudes for the mixtures of dipolse and quadrupole waves are taken into account in addition to electric dipole, electric quadrupole, and magnetic dipole amplitudes. The results turn out to be fairly improved compared with the dipole model, and roughly explain experiments. (auth)

15949

CALCULATION OF THE DIFFERENTIAL EFFECTIVE CROSS SECTION FOR THE SCATTERING OF MEDIUM ENERGY ELECTRONS BY ATOMS BY MEANS OF THE HARTREE FUNCTION. Herbert Wyrwich and Friedrich Lenz (Technischen Hochschule, Aachen). Z. Naturforsch. 13a, 515-23(1958) July. (In German)

For the calculation of the effective cross sections for the elastic and inelastic scattering of electrons by atoms in the Born approximation the atomic scattering factor of the shell electrons, which describes the shielding of the nuclear charge by the atomic shell, was determined from the Hartree functions in dependence on the dimensionless magnitude $\eta = 4\pi(a_H/\lambda)\sin(\vartheta/2)$, which is a measurement for the impulse propagated in the material. The results were compared with those calculated using other shell models. The Thomas-Fermi model in the calculation of the scattering section for small η leads to relatively large errors, while the atomic model of Wentzel (exponentially screened Coulomb field) gives a very good approximation for small η, when the screening radius was determined from the average quadratic electron distances in the atomic shell. For those atoms for which there is no Hartree function, an approximate determination of the screening radius was proposed from the atomic volume calculated from the atomic weight and density of solid bodies. The asymptotic ratio of the atomic scattering factor for large η was investigated for general cases. (tr-auth)

15950

THE RANGE OF LOW ENERGY ELECTRONS AND POSITRONS IN ALUMINUM. Klaus Gubernator (Univ. of Göttingen, Germany). Z. Physik 152, 183-93(1958). (In German)

In the energy range from 10 to 160 kev the range of monoenergetic electrons and positrons in aluminum was determined and the corresponding energy-range relation was derived. The following correlations between the energy E in Mev and the maximum range R in mg/cm^2 were found: for electrons $R^- = 773 \times E^{1,0}$, for positrons $R^+ = 759 \times E^{1,2}$. The maximum electron ranges are, at the same energy, about 12% higher than those previously determined experimentally and by about the same amount lower than the true ranges calculated by Nelms. The measured ratio of the positron range to the electron range is $R^+/R^- = 0.982 \times E^{0,2}$ (E in Mev) and agrees within the limits of error with the values of Nelms. The range of a positron is also lower than that of an electron of equal energy, which could be shown with the differentiated energy loss. (tr-auth)

15951

INVESTIGATION OF THE ENERGY DISTRIBUTION OF BACK-SCATTERED ELECTRONS IN THIN METAL LAYERS. H. Kulenkampff and K. Rüttiger (Univ. of Wurzburg, Germany). Z. Physik 152, 249-60(1958). (In German)

In a continuation of an earlier investigation on the back-scattering of electrons in thick layers, the energy distribution of back-scattered electrons in thin gold, nickel, and aluminum layers (0.1 to 0.6 mg/cm^2) was determined at an initial electron energy of 25 kv. The electrons impinged perpendicularly on the scattering foil. The Lenard opposing field method was used, which was however improved by superposing a small alternating current voltage with an opposing voltage and by amplifying the alternating current component of the initial current with a resonance amplifier. The curve of the energy distribution of the back-scattered electrons was obtained directly. The curve shows a continuous pattern which extended from the primary energy up to very small energies. With decreasing layer thickness the number of electrons back-scattered with the greater energy loss decreased, the number of the fastest did not change. The curve maximum was strongly marked at

small layer thicknesses and was displaced in aluminum and nickel to higher energies. In gold its position remained independent of the layer thickness in the range investigated. (tr-auth)

15952
SPECTRUM OF γ RAY SCATTERING AFTER PASSING A LEAD BARRIER. Yu. A. Kazanskii. pp. 123-7 in "Fizika i Teplotekhnika Reaktorov." Moscow, Publishing House on Atomic Power, 1958. 213p. (In Russian)

Data are presented on the spectral and angular distribution of γ-ray scattering after passing a lead barrier of thickness $\mu_0 r = 3.9$ (in free path range). (R.V.J.)

Radiation Effects

15953 AECU-3808
Illinois. Univ., Urbana.
LENGTH AND RESISTIVITY CHANGES OF GERMANIUM UPON LOW TEMPERATURE DEUTERON IRRADIATION AND ANNEALING (thesis). Technical Report No. 14. Frederick L. Vook. May 1958. 67p. Contract AT(11-1)-182. $10.80(ph OTS); $3.90(mf OTS).

Simultaneous measurements of length and resistivity of high-purity germanium single crystals were made upon irradiation and annealing. The specimens were initially irradiated at 25°K with deuterons of average energy 10.2 Mev to an integrated flux of 6.2×10^{16} deuterons/cm^2 and annealed to room temperature. The specimens were then irradiated at 85°K to an additional flux of 9.2×10^{16} deuterons/cm^2 and annealed to 364°K. The specific length expansion for both bombardments was found to be $\Delta L/L = 1.5 \pm 0.2 \times 10^{-21}$/deuterons/cm^2. The annealing for both runs showed a gradual recovery of the expansion beginning at approximately 200°K with recoveries of approximately 50% by 300°K and 85% by 360°K. An irreversible resistivity increase occurred on annealing between 85 and 140°K. The resistivity decreased irreversibly by a factor of 10^3 between 150 and 200°K. The irreversible annealing curves of the resistivity and volume expansion therefore do not show parallel behavior. If the damage is interpreted in terms of point defects, and if the length change recovery is caused by interstitial-vacancy annihilation, then the resistivity changes on annealing below 200°K are possibly caused by the association of defects in various cluster models. A possible cluster model that can explain the present length and resistivity changes on bombardment and annealing, as well as recent small angle x-ray scattering data consists of clusters of interstitials and vacancies not centered at the same point. It is possible that the vacancy and interstitial clusters may be produced directly upon irradiation in a rather coarse distribution suggested by previous small-angle x-ray scattering data at ~90°K. If so, present displacement theories are in serious error. (auth)

15954 AERE-E/R-2518
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE DEGRADATION OF PLASTICISED P.V.C. COMPOSITIONS UNDER HIGH LEVEL GAMMA RADIATION. Interim Report. H. Wells and I. Williamson. May 1958. 21p. $0.63(BIS).

Irradiation tests of various plasticizers for polyvinyl chloride which satisfy requirements for use in gasket or oil seal material are described. Of the materials tested, Reoplex polymeric plasticizers, dioctyl phthalate, dioctyl sebacate, and tritolyl phosphate, the latter resulted in polyvinyl chloride far less affected by gamma radiation of 10^7 to 10^8 r than the others. The Reoplexes were second best, the others being poor. The plasticizers constituted 40 wt. % of the test material. (T.R.H.)

15955 ANL-5706
Argonne National Lab., Lemont, Ill.
EFFECTS OF IRRADIATION OF SOME URANIUM–PLUTONIUM ALLOYS. Final Report—Metallurgy Program 6.5.3. Work Completed: March 1955. J. H. Kittel and L. R. Kelman. Jan. 1958. 23p. Contract W-31-109-eng-38. $0.75(OTS).

Irradiations were made on a number of uranium–plutonium alloy specimens made from both cast and extruded materials. The cast alloys included alloys of uranium with 3.7, 6.6, and 13.0 wt. % plutonium, and the extruded alloys included alloys of uranium with 9.5, 14.1, and 18.7 wt. % plutonium. One-half of the extruded specimens were given a heat treatment consisting of heating to 645°C and cooling to and holding at 500°C for one hour in an attempt to remove the preferred orientation that was anticipated from extrusion. The specimens were irradiated to burnups ranging up to 0.84 at. % with central temperatures ranging up to 490°C. The cast specimens were all found to have developed severe surface roughening as a result of the irradiation they received, presumably because of excessively large grain sizes present before irradiation. Identically fabricated unalloyed uranium specimens showed similar behavior. The as-extruded alloy specimens maintained good surface smoothness under irradiation, but showed elongations which were dependent on plutonium content. For example, in samples with 0.4 at. % burnup, a 14.1 wt. % plutonium alloy specimen elongated 96%, whereas an 18.7 wt. % plutonium alloy specimen elongated only 8.4%. The heat-treated extruded specimens did not elongate anisotropically, indicating that the heat treatment used was effective in randomizing the grain orientation. However, the heat-treated specimens developed excessive surface roughening, apparently because the heat treatment caused an undesirably large grain size. (auth)

15956 BMI-APDA-638
Battelle Memorial Inst., Columbus, Ohio.
STRESS-STRAIN PROPERTIES OF IRRADIATED URANIUM-10 w/o MOLYBDENUM. John E. Gates, Edward G. Bodine, J. Clarence Bell, Arthur A. Bauer, and George D. Calkins. Jan. 6, 1958. 48p. For Atomic Power Development Associates. $9.30(ph OTS); $3.60(mf OTS).

The stress-strain properties of the APDA reference alloy of uranium–10 wt. % molybdenum at various burnups up to 2.1 total at. % are described. Data were obtained on both irradiated and unirradiated specimens of the alloy by the use of a remotely operated bend-testing machine. Tensile properties of unirradiated material are also reported for comparison with data obtained from the bend tests. The mathematical procedure used in obtaining equivalent uniaxial stress-strain properties from the bend-test data is described in the Appendix. The results of the bend tests indicate that the physical properties of the reference alloy were severely affected by irradiation to burnups as high as 2.1 total at. %. At a test temperature of 500°C, the modulus of elasticity, ultimate strength, and strain at fracture decreased rapidly up to a burnup of about 0.5 to 1.0 total at. % with the rate of change decreasing thereafter. No important differences were noted between coextruded and hot-rolled material. An indication was obtained that the ultimate strength of the alloy was improved with in-

creasing irradiation temperatures up to about 500°C. Data obtained on unirradiated material indicated that ductility of the reference alloy was lower at 500°C than at room temperature. Stress-strain curves for the irradiated specimens are included. The value of these data is limited because of the large number of variables encountered in the specimen histories and the small number of tests involved in this program. (auth)

15957 NARF-58-35T
Convair, Fort Worth, Tex.
EFFECT OF RADIATION ON THE ELECTRICAL PROPERTIES OF ELECTRONIC COMPONENTS-V—RELAYS. A. B. Spears. Aug. 22, 1958. 83p. Project No. 6(1-9964). Contract AF33(600)-32054. (MR-N-216).

Nine types of relays were irradiated in the field of the Ground Test Reactor at a constant power level for a period of 92 hours. The integrated fluxes were approximately $10^{12} n_f/cm^2$ and 10^{10} ergs/gm carbon of gamma rays. The important operational characteristics of the relays were tested before, during, and after the irradiation. None of the relays suffered effects which would interfere with the functions for which they were designed; however, significant changes occurred which could not be attributed to any observed non-nuclear influences. It is probable, then, that the components were affected by the radiation. (auth)

15958 NP-6874
New York Univ., New York.
RESEARCH ON SOLID STATE RADIATION-INDUCED PHENOMENA. First Quarterly Report [for] April, May, June [1958]. Hartmut Kallmann. July 1958. 53p. Contract DA-36-039-SC-75043.

This report includes February and March, Contract No. DA-36-039-SC-73145, "Research of Fluorescence and Conductivity Phenomena."

Fluorescence induced by gamma ray and light excitation of the solvent of organic solutions in liquid and rigid solvents and by direct light excitation of the solutes is investigated and compared. The results lead to conclusions concerning energy transfer from solvent to solute. Light and gamma ray excitation of the solvent produce rather similar transfer at low solute concentrations. At higher concentrations the fluorescence due to energy transfer is larger under gamma ray excitation than under light if they are normalized at low concentrations. This is explained by the participation of higher states in the transfer process under this type of excitation. The efficiency of transfer is determined to be of the order of one. Solvents exhibiting weak or strong transfer efficiencies under gamma ray excitation show similar properties under light excitation. It is shown that transfer is determined mostly by the lowest electronic excited state of the solvent. Transfer in rigid systems is investigated and is found to be similar to that in liquids. Material diffusion does not occur in rigid systems and the results show that it is also insignificant for transfer in liquid systems. Addition of naphthalene results in enhancement of transfer in rigid systems to about the same degree as in liquids. Energy is transferred in rigid systems across atomic distances of at least 2×10^{-7} cm. The following processes were investigated in 7 selected phosphors which were maintained at room or lower temperature: (a) To what extent will short wavelength infrared (0.8μ or less) de-excite the phosphor? (b) To what extent will longer wavelength infrared (1.2μ or more) de-excite the phosphor? (c) What percentage of electrons caused to recombine by the above wavelengths will do this in a radiative way? (d) What mechanism is most reasonable to explain the action of infrared on the phosphors? For all except 2 commercial ZnCdS phosphors infrared of 0.72 microns or less was able to de-excite the phosphor nearly completely. Only the application of heat was able to completely empty the traps in the above mentioned ZnCdS phosphors. The longer wavelengths were progressively less able to empty traps. Infrared induced trap emptying was about 3% radiative for all except a special doubly activated phosphor. This leads to a model wherein infrared predominantly acts to free holes which then recombine in a non-radiative way with trapped electrons. (auth)

15959 TID-7515(Pt.2(Del.))
Division of Reactor Development, AEC.
PAPERS PREPARED FOR RADIATION EFFECTS REVIEW MEETING, CONGRESS HOTEL, CHICAGO, JULY 31—AUGUST 1, 1956. Aug. 1956. Decl. with Deletions June 13, 1958. 372p. $5.00(OTS).

Research in radiation effects on reactor materials is reviewed in ten papers presented by representatives of Oak Ridge National Laboratory, General Electric Company, Knolls Atomic Power Laboratory, Battelle Memorial Institute, Brookhaven National Laboratory, Argonne National Laboratory, Bettis Plant, and Atomic Power Development Associates. Separate abstracts have been prepared for each paper. (T.R.H.)

15960 TID-7515(Pt. 2)(Del.)(p.5-100)
Oak Ridge National Lab., Tenn.
A BRIEF SUMMARY OF RESEARCH ON RADIATION EFFECTS IN SOLIDS. p.5-100 [of] PAPERS PREPARED FOR RADIATION EFFECTS REVIEW MEETING, CONGRESS HOTEL, CHICAGO, JULY 31—AUGUST 1, 1956. 96p.

Research representative of work being done at Oak Ridge National Laboratory by the Solid State and Metallurgy Divisions is reviewed. Extensive graphic and tabular presentations are made of data from irradiations of Al—U alloys, stainless-steel-clad stainless steel—UO_2 dispersions, ThO_2—UO_2 ceramics, Si—SiC—UO_2 ceramics, Th, Th alloys, Th—U alloys, Al—B_4C, B_4C ceramics and cermets, magnesium oxychloride cement, iron, steels, stainless steels, Ni, Ni alloys, BeO, Al_2O_3—Cr cermet, glasses, ZrO_2, HfO_2, zircon, Al_2O_3, MgO, SiC, quartz, ThO_2, steatite, forsterite, cordierite, spinel, lava, muscovite mica, $BaO \cdot TiO_2$, TiO_2, and TiC—Nb—Ta. Radiation effects experience with thermocouples, electrical insulation, transformers, furnace and temperature control materials, bonded-wire strain gages and electric motors is briefly summarized. Work previously reported elsewhere is cited only by a literature reference. This presentation is not intended as a complete detailed coverage of ORNL work in the field. (T.R.H.)

15961 TID-7515(Pt. 2)(Del.)(p.101-26)
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
RADIATION EFFECTS ON MODERATOR, SHIELDING AND STRUCTURAL MATERIALS. Milton Lewis. p.101-26 [of] PAPERS PREPARED FOR RADIATION EFFECTS REVIEW MEETING, CONGRESS HOTEL, CHICAGO, JULY 31—AUGUST 1, 1956. 26p.

The accomplishments of the Hanford Atomic Products Operation of the General Electric Company in the field of radiation effects on reactor materials are briefly described with references to sources of more detailed information. Data are given from studies of radiation effects on the properties of graphite, heavy aggregate concrete, iron—masonite laminate, aluminum, aluminum alloys, zirconium, zirconium alloys, and plastics and elastomers used for seals, valve seats, insulation, containers, and pipes. (T.R.H.)

15962 TID-7515(Pt.2)(Del.)(p.156-69)
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
EVALUATION OF U–Mg MATRIX FUEL MATERIAL. Maxwell D. Freshley. p.156-69 [of] PAPERS PREPARED FOR RADIATION EFFECTS REVIEW MEETING, CONGRESS HOTEL, CHICAGO, JULY 31–AUGUST 1, 1956. 14p.

Samples of a proposed fuel material, U particles embedded in a Mg matrix, were subjected to burnups of 0.1, 0.5, 1.0, and 2.0% in the Materials Testing Reactor. The material was dimensionally stable after irradiation and bend tests showed that the mechanical properties were satisfactory. Damage to the mechanical properties appears to saturate after about 0.1% burnup. The U–Mg material is indicated to be more suitable for high specific power generation and high burnup application than solid U. (T.R.H.)

15963 TID-7515(Pt. 2)(Del.)(p.170-221)
Knolls Atomic Power Lab., Schenectady, N. Y.
RADIATION EFFECTS ON REACTOR MATERIALS—A REVIEW OF KAPL WORK. J. F. Eckel, C. A. Bruch, A. Levy, A. H. Willis, and W. E. Seymour. p.170-221 [of] PAPERS PREPARED FOR RADIATION EFFECTS REVIEW MEETING, CONGRESS HOTEL, CHICAGO, JULY 31–AUGUST 1, 1956. 52p.

Data are given from Knolls Atomic Power Laboratory studies of radiation effects on the following fuel, control, and structural materials: U–Zr alloy, U–Cr alloy, Mg–U dispersion, U, Th, UO_2–stainless steel dispersions, silica–U, Vycor–U, PuO_2–UO_2, B-stainless steel, B–Zr, B–Zircaloy-2, B–Ti, Gd_2O_3–Ti, Gd_2O_3–stainless steel, B_4C, steel, stainless steel, Cu, Ni, Ti, Zr, Fe, Mo, Fe single crystal, Pb single crystal, Zr single crystal, glasses, sintered carbides, and insulating materials. Programs in progress and proposed programs are described. (T.R.H.)

15964 TID-7515(Pt. 2)(Del.)(p.222-30)
Battelle Memorial Inst., Columbus, Ohio.
REVIEW OF RADIATION-EFFECTS PROGRAMS AT BATTELLE. H. A. Saller, R. W. Dayton, and G. D. Calkins. p.222-30 [of] PAPERS PREPARED FOR RADIATION EFFECTS REVIEW MEETING, CONGRESS HOTEL, CHICAGO, JULY 31–AUGUST 1, 1956. 9p.

The Battelle Memorial Institute program for development of boron-containing control materials is discussed. Data are given from irradiations of B, ZrB_2, B_4C, B_4C–Zircaloy-2, B–Ti, and B_4C–Ti. (T.R.H.)

15965 TID-7515(Pt.2)(Del.)(p.231-48)
Brookhaven National Lab., Upton, N. Y.
EFFECT OF RADIATION ON THE RATE OF OXIDATION OF GRAPHITE. W. L. Kosiba and D. H. Gurinsky. p.231-48 [of] PAPERS PREPARED FOR RADIATION EFFECTS REVIEW MEETING, CONGRESS HOTEL, CHICAGO, JULY 31–AUGUST 1, 1956. 18p.

The rate of oxidation of pile grade graphites in oxygen and air has been studied in a gamma radiation field, in a reactor radiation field, and in the absence of any radiation. Also, pile irradiated samples have been oxidized in a gamma radiation field. The oxidation rates observed in a reactor and in a gamma field are higher than that observed in the absence of these. The rates of oxidation of previously irradiated specimens is higher than non-irradiated specimens and this rate is enchanced by a gamma radiation field. The rate of oxidation in a reactor is flux dependent but not linearly dependent. Also, the rate of oxidation is lower in air than in oxygen. (auth)

15966 TID-7515(Pt. 2)(Del.)(p.249-67)
Argonne National Lab., Lemont, Ill.
ANL REACTOR MATERIALS IRRADIATION PROGRAM. S. H. Paine and J. H. Kittel. p.249-67 [of] PAPERS PREPARED FOR RADIATION EFFECTS REVIEW MEETING, CONGRESS HOTEL, CHICAGO, JULY 31–AUGUST 1, 1956. 19p.

The Argonne radiation damage program is reviewed and its correlation with the Laboratory's reactor engineering commitments is described. Understandably, the main emphasis in the ANL work has been the development of satisfactory nuclear fuels, although important work has also been done on structural metals. Significant results on damage to U and Th metals, their alloys, and miscellaneous fuel materials, including ceramics, are cited. A summary of the most acceptable of these is given, and the nature and direction of the present interests is discussed. (auth)

15967 TID-7515(Pt.2)(Del.)(p.268-306)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
SUMMARY OF BETTIS IRRADIATION DATA ON REACTOR FUEL, STRUCTURAL, AND CONTROL ROD MATERIALS. R. H. Fillnow. p.268-306 [of] PAPERS PREPARED FOR RADIATION EFFECTS REVIEW MEETING, CONGRESS HOTEL, CHICAGO, JULY 31–AUGUST 1, 1956. 39p. (WAPD-A1W(M)-366(Del.2).)

(Previously abstracted as report number WAPD-A1W (M)-366 (Del. 2) in Nuclear Science Abstracts, Vol. 12, abstract No. 8826.)

15968 TID-7515(Pt. 2)(Del.)(p.307-28)
[Atomic Power Development Associates, Inc., Detroit.]
RADIATION RESULTS OF SCREENING TESTS ON FUEL ALLOYS FOR THE APDA FAST BREEDER POWER REACTOR. D. O. Leeser, C. K. Leeper, G. D. Calkins, and D. D. VanHorn. p.307-28 [of] PAPERS PREPARED FOR RADIATION EFFECTS REVIEW MEETING, CONGRESS HOTEL, CHICAGO, JULY 31–AUGUST 1, 1956. 22p.

The Atomic Power Development Associates' irradiation program for development of a fuel alloy for the Fast Breeder Power Reactor is described. Data from irradiation experiments on U–Cr, U–Zr, and U–Mo are given. (T.R.H.)

15969 TID-7515(Pt. 2)(Del.)(p.329-72)
General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.
REVIEW OF RADIATION EFFECTS STUDIES AT THE AIRCRAFT NUCLEAR PROPULSION DEPARTMENT OF THE GENERAL ELECTRIC COMPANY. C. G. Collins. p.329-72 of PAPERS PREPARED FOR RADIATION EFFECTS REVIEW MEETING, CONGRESS HOTEL, CHICAGO, JULY 31–AUGUST 1, 1956. 44p.

Summaries are presented of data on radiation damage to elastomers, plastics, and organic liquids, and the relationship of damage by different types of radiation is discussed from the viewpoint of applying the data to estimate the stability of these materials in engineering applications. Experimental measurements are reported which indicate that the gas evolution from boric acid solutions is correlatable with the difference in energy absorption from neutrons and gammas. Radiation damage to Teflon–U_3O_8 fuel elements for critical experiments is also described. (auth)

15970
HOW RADIATION DAMAGES METALS. PART I. EFFECTS ON PHYSICAL PROPERTIES. M. J. Makin (Atomic Energy Research Establishment, Harwell,

Berks, Eng.). Atomics and Nuclear Energy 9, 260-3 (1958) Aug.

The effects of subjecting metals to high-energy radiation are discussed, from both theoretical and practical aspects. Four different ways are described in which a fast particle can interact with a metal. (A.C.)

15971

SCALE-UP OF RADIATION EFFECTS. E. J. Henley (Columbia Univ., N. Y.); N. F. Barr (Sloan Kettering Inst., New York); S. Thomson (Brookhaven National Lab., Upton, N. Y.); and E. R. Johnson (Stevens Inst. of Tech., Hoboken, N. J.). Chem. Eng. Progr. 54, No. 6, 69-72(1958) June.

The relationship between radiation effects and rate of energy transfer was investigated. The yields of radiation-induced chemical reactions in solution depend on the rate of energy loss of the radiation; in organic solids cross-linking, degradation, and change in mechanical properties are dependent on dose rate and linear energy transfer. In metals, little or no dose rate dependence is expected. Inorganic solids are being studied for radiation effects at present. The G-values of gas-phase radiation reactions are not changed by the intensity of radiation; however, pressure and temperature changes are expected to affect the G-value. (J.R.D.)

15972

EFFECTS OF RADIATION ON VIDICON PERFORMANCE. R. A. Davidson and B. H. Rosen (RCA, Camden, N. J.). IRE Trans. Nuclear Sci. NS-5, 46-9(1958) Aug.

A commercial one-inch vidicon was exposed to a total radiation dosage of approximately 10^{15} nvt in the Brookhaven National Laboratories Nuclear Reactor. Quantitative tests were devised for measuring tube aperture response, signal, noise, and photoconductor "dark" current. No measurable degradation of performance occurred, except for decrease in signal output, which was attributed to radiation browning of the vidicon glass faceplate. (auth)

15973

RADIATION EFFECTS FROM (n,α) REACTIONS IN BORON GLASS AND ENERGY OF THE REACTING NEUTRONS. C. Mylonas and R. Truell (Brown Univ., Providence). J. Appl. Phys. 29, 1252-60(1958) Aug.

The damage produced in neutron-irradiated boron glass by the products of the (n,α) reaction appears as a pronounced optical birefringence. This birefringence is shown to be due to macroscopic stresses resulting from volume contraction of the glass. The variation of strain with depth from the glass surface is found to fit to a remarkable degree the space rate of decay of radiation of suitable velocity distribution and random direction. This permits the determination of the neutron velocity by one-velocity theory, or of the most probable velocity for a Maxwellian neutron distribution; in addition the average volume contraction corresponding to a single neutron-boron reaction is found to be equal to 3.6×10^{-19} cm^3 per (n,α) reaction. (auth)

15974

EFFECT OF PLASTIC DEFORMATION ON THE γ-RAY COLORATION OF NaCl CRYSTALS. A. S. Nowick (Columbia Univ., New York). Phys. Rev. 111, 16-25 (1958) July 1.

Measurements are made at room temperature of the growth of the F-band in NaCl crystals, under gamma irradiation in a Co^{60} source of constant intensity. Crystals of different origins, heat treatments, and states of deformation, are examined. While deformation has only a relatively small effect on the colorability in the early stage of F-band growth, the effect on the later stage is quite striking. The annealed crystals appear to saturate sharply at a value close to 10^{17} F-centers/cm^3, except for a small linear increase with time, while the deformed crystals continue to show a high growth rate in the later stage of irradiation. Upon optical bleaching, the deformed crystals show R-bands, while undeformed crystals irradiated for the same time show no absorption maxima in the visible range. These and other observations confirm the concept advanced earlier that the first stage is due to vacancies and vacancy clusters present in the crystal prior to irradiation (which are determined by the impurity content of the crystal) while the second stage involves the generation of new vacancies at dislocations. (auth)

15975

EFFECT OF FRACTIONAL X-IRRADIATION OF NaCl CRYSTALS ON F-CENTER DENSITY. W. E. Bron and A. S. Nowick (Columbia Univ., New York). Phys. Rev. 111, 26-7(1958) July 1.

An attempt is made to verify an effect reported by Lin whereby the F-center density in an alkali halide crystal irradiated over only part of its cross section is proportional to the fraction of the crystal exposed to the x-ray beam. These experiments fail to verify Lin's result, and in fact show that, within experimental error, the F-center density produced in a crystal exposed to a given intensity of x rays for a given time is independent of the fraction of the crystal irradiated. (auth)

15976

INVESTIGATION OF THE ELECTRIC CONDUCTIVITY OF INSULATING MATERIALS BEFORE, DURING AND AFTER IRRADIATION. I. M. Rozman and K. G. Tsimmer. Zhur. Tekh. Fiz. 26, 1661-88(1956). (Translated from Referat. Zhur. Fiz. No. 5, 1957, Abstract No. 12083.)

A description is given of the application of capacitor ionization chambers for the measurement of the electric conductivity of insulating materials before, during, and after irradiation. The chamber is also used for the determination of the dependence of the electric conductivity on the temperature. The construction of the capacitor ionization chamber is given. The change in the potential of the chamber under the influence of ionizing radiation is estimated. Measurements were made of pressed amber, polystyrol of different degrees of purity, polymethylmetacrylate, polyethylene, and polychlorfluoroethylene, and the results are tabulated. The reproducibility of the measurements was shown to be good. (J.S.R.)

Radioactivity

15977

IMPROVEMENT OF THE BACKGROUND IN α SPECTROGRAPHY AND PREPARATION OF SOURCES. G. Bastin-Schoffier and M. R. J. Walen (C.N.R.S., Bellevue). J. phys. radium 19, 527-31(1958) May. (In French)

A systematic study of the background of magnetic alpha spectra shows that the only factors of importance are the adsorption of the radio substance on its backing, the self-absorption, and the scattering in the spectrograph. By the use of very pure radio substances, very thin source backings, and the careful definition of the beam by slits, it was possible to reduce the background by a factor of more than 100 and to detect with certainty rays with a relative intensity of 10^{-6}. (tr-auth)

15978

REMARKS ON THE PARTICLES WITH AN ABNORMALLY LONG PATH EMITTED BY THE RADIOELEMENTS. Marie Ader (Laboratoire de Physique Atomique et Moléculaire, Collège de France). J. phys. radium 19, 615(1958) June. (In French)

The examination of nuclear emulsions exposed to neutron irradiation and α irradiation reveals particles with an abnormally long path. The tracks of these particles do not resemble those of α particles, but those of protons. It is possible that the particles are the result of (α,p) reactions with the constituents of the air, nitrogen, oxygen, and carbon. An analysis of the energies and masses reveals that N^{14}, N^{15}, and C^{12} would be responsible only for paths less than 100 μ in the emulsion. (J.S.R.)

15979

POSSIBLE EXPERIMENTS FOR DETERMINATION OF BETA INTERACTIONS. I. M. Morita and R. S. Morita (Columbia Univ., New York), and M. Yamada (National Research Council, Washington). Phys. Rev. 111, 237-44(1958) July 1.

Some possible experiments are proposed for deciding the relative strength of scalar and vector interactions and that of tensor and axial vector interactions in beta decay. For all the proposed experiments, it is necessary to measure the recoil of the nucleus directly or the nuclear resonance fluorescence caused by a gamma ray which follows the beta decay or K capture. Formulas are given for decays involving the beta-gamma cascades and K capture-gamma-gamma cascades. Possible experiments are described for decays involving beta-gamma-gamma cascades, but explicit formulas are not given. They will be presented in a subsequent paper. These experiments will also determine whether the beta interaction is the same for both signs of the electric charge. (auth)

15980

MULTIPOLE MIXING IN ODD MASS SPHEROIDAL NUCLEI. Ryuzo Nakasima (Osaka City Univ.) and Shuichiro Yamasaki and Yasukazu Yoshizawa (Osaka Univ.). Progr. Theoret. Phys. (Kyoto) 19, 31-42(1958) Jan.

The multipole mixing and half-lives of gamma transition of odd mass nuclei are studied in the rare earth region. The relatively large E2/M1 ratios observed in rotational transitions are found to be consistent with the strong coupling model. Many long-life transitions have been found between different rotational families. Some of them are explained by using Nilsson's wave functions in spheroidal potential. (auth)

15981

THE ISOTOPE INDEX. THE COMPLETE PURCHASING GUIDE TO THE ISOTOPES. MAY 1958 INTERNATIONAL EDITION. Vol. 3, No. 1. J. L. Sommerville, ed. Indianapolis, Scientific Equipment Co., 1958. 120p. $3.00 U. S. and Canada, $3.50 Foreign.

The Isotope Index is primarily a source and purchasing guide to isotopes. Isotopes are arranged in alphabetical order by element name and then in order of atomic weight. Information is included on the half-life and principle radiation, and where available, the percentage of each radiation. Also included is available information on the different forms in which the isotope is available, the specific activity, the cost, the concentration if the isotope is in solution, other isotopes if present, delivery information, the manufacturer or supplier, and the catalog number. The procedures for licensing of users of radioisotopes as revised by the Atomic Energy Commission, 1956, are included. (C.H.)

Rare Earths and Rare-earth Compounds

15982 AFOSR-TN-58-543

Hebrew Univ., Jerusalem.

THE PARAMAGNETIC RESONANCE SPECTRUM OF GADOLINIUM IN HYDRATED LANTHANUM TRICHLORIDE. Technical Note No. 2. M. Weger and W. Low. May 1958. 16p. (AD-158360).

The paramagnetic resonance spectrum of Gd^{3+} in $LaCl_3 \cdot 7H_2O$ was measured and found to agree quite well with a spin Hamiltonian with dominant coefficients $b_2^0 = \pm 0.0131$ cm^{-1}, $b_2^2 = \pm 0.0075$ cm^{-1} at room temperature, and $b_2^0 = \pm 0.0099$ cm^{-1}, $b_2^2 = \pm 0.0115$ cm^{-1} at liquid air temperature. (auth)

15983 UCRL-8192

California. Univ., Berkeley. Radiation Lab.

NUCLEAR STUDIES IN THE RARE EARTH REGION (thesis). Kenneth S. Toth. Mar. 1958. 115p. Contract W-7405-eng-48. $2.50(OTS).

Alpha particles from the Berkeley 60-in. cyclotron have been used to bombard rare earth oxides in an effort to study the neutron-deficient isotopes in the rare earth region. New isotopes have been discovered and their mass numbers determined. These include two new alpha emitters, Dy^{153} (5 hr) and Dy^{154} (13 hr), and two new electron-capture isotopes, Dy^{155} (10 hr) and Ho^{159} (33 min). Two other alpha emitters, Dy^{152} (2.5 hr) and Tb^{151} (19 hr), have been assigned mass numbers. In addition, nuclear spectroscopic studies have been made on the gamma rays emitted following the decay of a number of isotopes in the same region of the periodic chart. Of these isotopes Tb^{151}, Tb^{153}, Tb^{154}, Dy^{155}, and Ho^{160} are discussed in detail. Decay schemes have been proposed for Tb^{153}, Dy^{155}, and Ho^{160}. The energies of the gamma rays were determined by use of permanent-magnet spectrographs to measure the energies of the conversion electrons resulting from these gamma rays. Gamma-ray spectra have been obtained for a large number of nuclides by the use of a scintillation counter in connection with a 100-channel gamma analyzer. Evidence is also presented for the discovery of another isotope, Dy^{149} (8 min), which was produced by a nitrogen-ion bombardment on praseodymium. The isotope decays either by the emission of positrons or by electron capture or by both modes of decay. Rare earth alpha systematics have been brought up-to-date. New partial alpha half lives have been calculated and are presented together with other new data available on rare earth alpha emitters. Alpha-decay energies have been plotted versus neutron number. This plot has been used together with known beta-decay energies in closed energy cycles to predict decay energies that are unknown experimentally. Partial alpha half lives have been plotted versus alpha-decay energies. Trends have been noticed in connection with this particular plot and possible explanations for these trends have been offered. (auth)

15984

NUCLEAR ORIENTATION EXPERIMENTS WITH Pr^{142} AND Yb^{175} NUCLEI. J. M. Daniels, J. L. G. Lamarche, and M. A. R. Le Blanc (Univ. of British Columbia, Vancouver). Can. J. Phys. 36, 997-1009(1958) Aug.

Pr^{142} has been oriented as an impurity in cerium magnesium nitrate, and the anisotropy of the 1.57-Mev γ ray was measured as a function of temperature in the

range 0.003 to 1.0° K, both in zero external field and in a field of 320 gauss parallel to the trigonal crystal axis. The results are not consistent with what has been published about the spin Hamiltonian of Pr^{3+} in this lattice. The magnetic moment of Pr^{142} is very small, and it was not possible to see any saturation of the anisotropy at low temperatures. Values for the magnetic moment of Pr^{142} were found for two different assumed decay schemes, these are 0.11 nuclear magnetons for the spin assignments $2 \xrightarrow{0} 2 \xrightarrow{2} 0$, and 0.15 nuclear magnetons for the spin assignments $2 \xrightarrow{1} 2 \xrightarrow{2} 0$. Similar experiments were carried out on Yb^{175}. Measurements were made in a variety of external magnetic fields up to 700 oersted, and at temperatures as low as 0.003°K. No anisotropy was observed for the 396 kev γ ray, nor the 282 kev γ ray. The most likely explanation for this result is that the lifetime of the γ-emitting state is about 10^{-10} seconds. The relation between the results of this experiment and others on the same isotope (Phil. Mag. 2, 1079 (1952)) is discussed. (auth)

15985

EXPERIMENTAL EVIDENCE FOR AXIAL VECTOR INTERACTION IN THE DISINTEGRATION OF Pr^{144}. R. L. Graham, J. S. Geiger, and T. A. Eastwood (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Can. J. Phys. 36, 1084-1111(1958) Aug.

A detailed study of the disintegration scheme of Pr^{144} has been carried out using lens spectrometers, scintillation spectrometers, and fast coincidence techniques. The 2293 kev β-component (1.3%) studied in coincidence with γ 691 has a predominantly first forbidden unique shape and the β-γ directional correlation is strongly anisotropic. The results indicate a probable spin-sequence $0-(\beta)\ 2+(\gamma)0+$, but the accuracy is not sufficient to exclude completely a 1−assignment for the Pr^{144} ground state. The β 803 component (1.0%) observed in coincidence with γ 2181 has an allowed shape and the β-γ directional correlation is isotropic. The shape of the total β-spectrum was studied in a double lens spectrometer having good anti-scattering properties using sources of Ce^{144} oxide sublimed onto 200 $\mu g/cm^2$ Al leaf. Subtraction of a unique (B_{ij}) shape 2293 kev 1.3% component and an allowed shape 803 kev 1.0% component yields the ground state β-spectrum. Analyses were made using the electronic functions of Zerianova which assume uniform charge distribution with $\rho = 1.2\ A^{1/3}\ 10^{-13}$ cm as well as the point charge functions of Rose with $\rho = 1.41\ A^{1/3}\ 10^{-13}$ cm. The observed spectrum shape can be explained on 0− to 0+ selection rules only by the axial vector interaction. Limits on the permissible tensor or pseudoscalar admixtures with the axial vector are discussed. No acceptable fit is possible with tensor, pseudoscalar, or any TP admixture (interfering or not) using Rose and Osborn's pseudoscalar formalism. (auth)

15986

ON THE CRITICAL POINT ON THE CURVE OF A POLYMORPHOUS CERIUM TRANSFORMATION. E. G. Ponyatovskii. Doklady Akad. Nauk S.S.S.R. 120, 1021-3 (1958) June 11. (In Russian)

Thermographic analysis of the cerium P-T diagram was made in order to determine the critical point of polymorphous cerium transformations. Diagrams were plotted for the α-α' transformation for specimens with (in %) <0.75 Nd, <0.75 Pr, 0.01 Fe, and $<1 \times 10^{-4}$ Pb at up to 18,500 kF·cm² pressure and up to 280°C. The equilibrium curve for α-Ce and α'-Ce shows that the phase transition of the first type changes to the phase transition of the second type; moreover, the changes in α-Ce and α'-Ce symmetry results from the differences in the electron shell symmetry and not in the lattice symmetry. The curve of the first type transition ends in the critical point; beyond the critical point neither first nor second type phase transition was observed. (R.V.J.)

15987

THE THERMODYNAMIC PROPERTIES OF NEODYMIUM HYDROXIDE $Nd(OH)_3$, IN ACID, NEUTRAL AND ALKALINE SOLUTIONS AT 25°; THE HYDROLYSIS OF THE NEODYMIUM AND PRASEODYMIUM IONS, Nd^{3+}, Pr^{3+}. R. Stuart Tobias and A. B. Garrett (Ohio State Univ. Columbus). J. Am. Chem. Soc. 80, 3532-7(1958) July 20.

The equilibria between neodymium hydroxide, hydrogen ions, and hydroxide ions were studied by measuring the solubility of the neodymium hydroxide in dilute hydrochloric and perchloric acids, neutral water, and sodium hydroxide solutions. Data on equilibrium constants and free energy changes are presented, and to confirm conclusions drawn from the solubility data, the hydrolysis of the trivalent ions of neodymium and praseodymium were studied, basing the hydrolysis constant on the hydrogen ion concentration at which the hydrolysis began. (J.R.D.)

Shielding

Refer also to abstracts 16071 and 16073.

15988 ORNL-2193

Oak Ridge National Lab., Tenn.

RADIATION ATTENUATION CHARACTERISTICS OF STRUCTURAL CONCRETE. E. P. Blizard and J. M. Miller. Aug. 29, 1958. 53p. Contract W-7405-eng-26. $1.50(OTS).

An expanded version of data previously published in ORNL-2081, p.157(1956).

An experiment was performed at the Lid Tank Shielding Facility to determine the dependence of the neutron attenuation of a structural concrete shield on the amount and placement of water hydrogen throughout the shield. It was found that a 7 wt. % water content is adequate to ensure that intermediate-energy neutrons are quickly slowed down to thermal energy, at which energy they are easily captured. A greater water content improves the over-all neutron attenuation according to the removal cross-section theory. In addition to the investigation of the neutron attenuation, the measured gamma-ray attenuation was compared with the predicted gamma-ray attenuation obtained in a calculation using buildup factors determined by the moments method. The two values were in good agreement. (auth)

15989 ORNL-2195

Oak Ridge National Lab., Tenn.

A STUDY OF THE NUCLEAR AND PHYSICAL PROPERTIES OF THE ORNL GRAPHITE REACTOR SHIELD. T. V. Blosser, G. W. Bond, L. A. Lee, D. T. Morgan, J. F. Nichols, R. C. Reid, A. B. Reynolds, T. O. P. Speidel, D. W. Vroom, and M. A. Welt. Sept. 8, 1958. 43p. Contract W-7405-eng-26. $1.25(OTS).

A study of the nuclear and physical properties of the concrete shield of the ORNL Graphite Reactor was performed both to determine the radiation attenuation characteristics of the shield and to discover any effects of a long-term (12-year) irradiation. In the experiment neutron and gamma radiation measurements were made in a 4⅝-in.-diam. hole in the shield as the hole was drilled in increments of 1 or 1/2 ft. Concrete plugs were

always placed behind the detectors to simulate a homogeneous shield. The average relaxation length for gamma rays in the barytes-haydite concrete, of which most of the shield is made, was found to be approximately 13.6 cm, increasing gradually from 13.0 cm at a shield thickness of 2 ft to 14.6 cm at a shield thickness of 5 ft. The fast-neutron relaxation length in the barytes-haydite concrete varied from 10.0 cm to 10.6 cm, the average being approximately 10.2 cm. Measurements of the streaming of radiation through the hole were also made. The concrete dust collected from the drillings was used to determine the chemical composition, water content, density, compressive strength, and radioactivity of the shield at the various depths. The temperature gradient through the shield was also measured. This investigation showed that the chemical properties and density of the shield have not changed appreciably since a similar investigation in 1948, but its compressive strength is lower (~40% near the reflector-shield interface). (auth)

15990 WASH-152(Del.)
Division of Reactor Development, AEC.
REACTOR SHIELDING INFORMATION MEETING, CHICAGO, NOVEMBER 12 AND 13, 1953. Mar. 1954. Decl. with deletions Mar. 6, 1957. 106p. $16.80(ph OTS); $5.70(mf OTS).

Thirty-one papers are presented on reactor shielding design and development including experimental and theoretical problems. The titles are: Neutron Capture Gamma-Ray Spectra; Gamma-Ray Streaming through Cylindrical Voids in Water; The Effects of Impurities on the Streaming of Neutrons through Iron; The Transmission of Na^{24} Gamma-Rays through Lucite and Steel for Several Angles of Incidence; The NDA Shielding Programs; Neutron Penetration in Hydrogen and the Removal Cross Section Concept; Experimental Breeder Reactor Shield Measurements; Monte Carlo Studies; Solution of Gamma-Ray Diffusion Problems by Random Sampling Methods; Discussion of Certain Boundary Effects Upon the Propagation of Gamma Rays; Gamma Radiation from Inelastic Scattering of 3.1-Mev Neutrons; Analysis of the Scintillation Spectrometer Observations of the Penetration of Cs^{137} Gamma Radiation through Water; Fast Neutron Removal Cross Sections; Neutron Spectra in Water; Attenuation of 14-Mev Neutrons in Water; Slant Penetration of Neutrons in Water; Attenuation of Neutrons through Thick Shields; Ground Scattering of Co^{60} Gamma Rays; Analysis of Experimental Scattering of D(d,n) Neutrons from a Plane of Aluminum; Gamma Spectrum of the Bulk Shielding Reactor; Prompt Fission Gamma Rays; Broad Beam Gamma Attenuations; Lithium Iodide Crystals; Air Duct Tests; The Semi-Analytical Method of Shield Design; Reactor Leakage for Shielding Calculations; Fast Neutron Dosimetry; Capture Gamma Ray Studies; Energy Effects in Reactor Shields; Numerical Studies of Non-Axial Distributions from Disk Sources of Radiation; Calculation of the Bremsstrahlung from Li^{8} Electrons. (T.R.H.)

15991 WASH-174(Del.)
Technical Information Service, AEC.
REACTOR SHIELDING INFORMATION MEETING SCHENECTADY, MAY 13 AND 14, 1954. 193p. $30.30 (ph OTS); $8.70(mf OTS).

Thirty-one papers covering practically all phases of reactor shielding and related studies are included. A chronology of reactor shielding and the present status of shielding theory and microscopic nuclear data as presented in Papers 1 and 2, respectively, lay the foundation for the more specific papers which follow. Specific related theoretical computations and experimental measurements discussed include: neutron and γ attenuation in Hanford shielding materials; neutron and γ transmission through air slots; penetration of 6-Mev γ rays in H_2O, Fe, and Pb; moments method calculation of neutron penetration through light materials; stochastic calculations of γ diffusion; use of Boral in shielding; dose measurements in air and H_2O; slowing down, attenuation, and slant penetration of neutrons in H_2O; γ doses due to irregular geometry in slab shields; flux characteristics of extended sources; secondary γ production; broad-beam γ attenuations; thermal neutron flux calculation for EBR; survey of the BNL shielding program; and Monte Carlo calculations of neutron penetration in H_2O. A book-type subject index has been prepared to facilitate the locating of the information. (L.M.T.)

Spectroscopy

Refer also to abstract 15982.

15992 NP-6924
Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
THEORETICAL AND EXPERIMENTAL STUDY OF MOLECULAR-BEAM MICROWAVE SPECTROSCOPY. Technical Report No. 336. Martin Peter and M. W. P. Strandberg. Aug. 26, 1957. 53p. Project 3-99-00-100. Contract DA-36-039-sc-64637.

Also published as Technical Report No. 1 on Contract DA-36-039-sc-73014.

A variety of topics that bear directly upon the use of molecular-beam spectroscopic methods for precise frequency determination with the use of alkali-halide molecules are discussed. The rotational-energy spectrum, including resolvable hyperfine structure arising from quadrupole and magnetic interactions, is calculated. An analysis of integrated line strength, or intensities, is presented. State selection is discussed in terms of the appropriate high-field Stark effect, for which new calculations are given. State selection with both axial and transverse-rod configurations is discussed, and trajectories for sodium chloride with the use of a transverse-rod state selector are indicated. The limitations of any state selector which arise from nonadiabatic losses are analyzed. The design parameters of a microwave spectroscope, including signal-to-noise ratio and ultimate precision, are related to its geometric configuration, and a description of an apparatus that is adequate for high-resolution work is given. Related topics, such as the concept of efficiency of frequency measurements and frequency pulling, are discussed in generalized fashion. Conclusions that can be derived from this work, as to both present limitations and necessary future development, are drawn. (auth)

15993
FIELD-INDUCED ABSORPTION IN HYDROGEN. M. F. Crawford and R. E. MacDonald (Univ. of Toronto). Can. J. Phys. 36, 1022-39(1958) Aug.

An investigation is reported of the fundamental rotation-vibration absorption induced in hydrogen by an electric field. The integrated absorption coefficients of the first four components of the Q branch have been measured for a range of field strengths at densities of 83.9 and 44.6 Amagat. The integrated absorption coefficient of the S(1) line has been determined at the higher density for one high field strength. The relative intensities of the Q components are in good agreement with the predicted ratios. Accurate experimental values of the matrix element of the mean value of the polarizabil-

ity, $(\alpha)_{01}$, and the matrix element of its anisotropy $(\gamma)_{01}$ have been obtained. They are: $(\alpha)_{01} = 0.968 \times 10^{-25}$ cm^3, and $(\gamma)_{01} = 0.72 \times 10^{-25}$ cm^3 at 83.9 Amagat, and are only slightly dependent on density. The frequencies of the lines have been measured. Only Q(1) and S(1) show a measurable shift with density. The optical collision diameter has been determined and is very small, 0.26A. (auth)

15994

ABSORPTION SPECTRA OF ACETYLENE AND ACETYLENE-d_2 IN THE VACUUM ULTRAVIOLET. P. G. Wilkinson (Univ. of Chicago). J. Mol. Spectroscopy 2, 387–404(1958) Aug.

The absorption spectra of acetylene and acetylene-d_2 have been photographed at high dispersion in the 1280 to 1520A region. The vibrational structure of two Rydberg transitions at 65814 cm^{-1} (3R-A) and 74498 cm^{-1} (3R'-A) previously reported by Price has been analyzed. Both of these transitions possess simple vibrational structure composed of only totally symmetric vibrations and must, therefore, be linear or very nearly so. However, a third transition (C-A) involving a trans-bent upper state has been found at 74747 cm^{-1} and, in addition, a fourth transition (B-A) at 74622 cm^{-1} involving a trans-bent and twisted upper state has been identified. The vibration identified in state 3R is $(C_2H_2): \nu_2(\sigma_g) = 1849$ cm^{-1}; $(C_2D_2): \nu_2(\sigma_g) = 1720$ cm^{-1}. Those in state 3R' are (C_2H_2) $\nu_1(\sigma_g) = 2748$ cm^{-1}, $\nu_2(\sigma_g) = 1781$ cm^{-1} and $\nu_4(\pi_g) = 393$ cm^{-1}; (C_2D_2); $\nu_1(\sigma_g) = 2053$ cm^{-1}, $\nu_2(\sigma_g) = 1559$ cm^{-1} and $\nu_4(\pi_g) = 302$ cm^{-1}. The four vibrations identified in state B are $(C_2H_2): \nu_1(a_g) = 2808$ cm^{-1} $\nu_2(a_g) = 1500$ cm^{-1}, $\nu_3(a_g) = 759$ cm^{-1} and $\nu_5(a_u) = 630$ cm^{-1}; $(C_2D_2): \nu_1(a_g) = 2303$ cm^{-1}, $\nu_2(a_g) = 1342$ cm^{-1}, $\nu_3(a_g) = 635$ cm^{-1} and $\nu_5(a_u) = 438$ cm^{-1}. The $\nu_4(b_u)$ vibration has also been tentatively identified with magnitudes ~ 1880 cm^{-1} (C_2H_2) and ~ 1100 cm^{-1} (C_2D_2). In state C two vibrations are identified with magnitudes $(C_2H_2): \nu_2(a_g) = 1751$ cm^{-1}, $\nu_3(a_g) = 434$ cm^{-1}; $(C_2D_2): \nu_2(a_g) = 1542$ cm^{-1}, $\nu_3(a_g) = 365$ cm^{-1}. The moment of inertia I_x is small in both B and C states causing sub-band separations of 10 to 100 cm^{-1}. The rotational constants are: $B \sim C \sim 1$ cm^{-1}. $A \sim 7$ cm^{-1} (C_2D_2) and ~ 8 cm^{-1} (C_2H_2) in both bent upper states. Vibrational data are given for all of the observed transitions. The identification of the observed states with some of those predicted by Mulliken is open to criticism. However, it is suggested that state C is Mulliken's A_u, predicted to lie at 8.63 ev and state B is Mulliken's $^1B_u(V_\pi)$ which interacts with 3R' causing some nonlinearity in the latter. (auth)

15995

ISOTOPE SHIFTS IN HAFNIUM. William L. Barr (Univ. of California, Berkeley). J. Opt. Soc. Am. 48, 658-62(1958) Sept.

Isotope shifts are reported for all stable isotopes of hafnium. The ratios found are: $\Delta\sigma(180-178):\Delta\sigma(178-176):\Delta\sigma(176-174) = 100:82.6 \pm 3.5:87.6 \pm 3.7$ and $\Delta\sigma(180-178):\Delta\sigma(180-179):\Delta\sigma(178-177) = 100:61 \pm 9:73 \pm 8$. The variation of the shifts with neutron number and the even-odd staggering are well beyond experimental error, and are therefore real. Magnitudes of the shifts observed in the spectral lines ranged from 29 to 46 mK. Centroids of the hyperfine-structure patterns due to the odd isotopes were located by using known ratios of the nuclear moments or of the hyperfine-structure parameters. The difference in the electric quadrupole moments between isotopes are discussed from the point of view of isotope-shift anomalies. (auth)

15996

A FAST NEUTRON TIME-OF-FLIGHT SPECTROMETER. G. Hrehuss, A. Neszmélyi, and K. Simonyi (Polytechnic Univ., Budapest). Periodica Polytechnica Elec. Eng. 2, 131-40(1958).

A fast neutron time-of-flight spectrometer for the energy range 0.8 to 14 Mev was developed for the investigation of the reaction mechanism of highly excited nuclei by means of inelastic scattering experiments. Its design and performance are discussed. (J.E.D.)

15997

MICROWAVE ZEEMAN EFFECT AND THEORY OF COMPLEX SPECTRA. F. R. Innes (Air Force Cambridge Research Center, Bedford, Mass.) and C. W. Ufford (Univ. of Pennsylvania, Philadelphia). Phys. Rev. 111, 194-202(1958) July 1.

A treatment in spherical tensors of the microwave Zeeman interaction of Abragam, Kambe, and Van Vleck is given. A calculation of g factors in atomic oxygen is then made and the numerical values compared with those worked out previously. New methods and results are developed for finding matrix elements of one-particle and two-particle operators for wave functions which contain more than one group of equivalent particles. The generality of these results is such that they may be used in the various coupling schemes of atomic and nuclear shell models. (auth)

15998

PRECISION MEASUREMENTS OF MILLIMETER AND SUBMILLIMETER WAVE SPECTRA: DCl, DBr, AND DI. Monroe Cowan and Walter Gordy (Duke Univ., Durham, N. C.). Phys. Rev. 111, 209-11(1958) July 1.

Precision frequency measurements have been made on the J = 0→1 transitions of the deuterium halides DCl, DBr, and DI. The molecular constants derived from these measurements are tabulated. (auth)

Theoretical Physics

15999 CERN-58-18

European Organization for Nuclear Research, Geneva. INTRODUCTION TO ISOBARIC SPIN SPACE AND ELEMENTARY PARTICLES. R. Hagedorn. July 1958. 57p.

Lecture given at the Summer School for Theoretical Physics, 1957, Oberwolfach, Germany.

This lecture reflects the state of affairs at about spring, 1957, and has not been brought up to date. It is not intended as a survey of the field but rather as an introduction, which does not presuppose any knowledge but should enable the reader to understand the literature. Although it was delivered to younger theoreticians, the formalism is simple enough that it should be readable for anybody who has participated in a lecture on quantum mechanics. (auth)

16000 NYO-7119

Carnegie Inst. of Tech., Pittsburgh. ELECTROMAGNETIC EFFECTS IN MESON THEORY. Raymond Andrew Sorensen. May 1958. 124p. Contract AT(30-1)-882. $19.80(ph OTS); $6.30(mf OTS).

The dominant part of phenomena involving π mesons and nucleons is charge independent. In view of such observed deviations from the law of isotopic spin conservation as the proton-neutron mass difference, the charged-neutral meson mass difference, and more recently observed discrepancies in the dispersion relations for meson scattering, it is desirable to investigate the effects of the electromagnetic interaction in an otherwise charge independent meson theory. A method is developed for taking the derivative of the scattering matrix with respect to the electric charge. This leads to an expression for the proton-neutron mass difference in terms of

certain Heisenberg matrix elements, some of which can be evaluated from independent experimental data. Those which can be evaluated give a mass difference of about the right magnitude but the wrong sign. A modification of the method is used in the static-nucleon theory to investigate the electromagnetic effects in meson-nucleon scattering. The effects are not negligible and should be considered in making an analysis of the scattering data. (auth)

16001 NYO-8733

Pennsylvania. Univ., Philadelphia.

A GENERALIZED REACTION MATRIX APPROACH TO THE THEORY OF THE INFINITE MEDIUM OF FERMIONS. Richard Prange and Abraham Klein. [1958]. 47p. Contract AT(30-1)-2202. $7.80(ph OTS); $3.30(mf OTS).

A closed set of coupled, non-linear integral equations are obtained which completely describe a system of Fermi particles. The equations define the one and two-particle Green's functions which are completely analogous to those used in the field theory of fundamental particles. Special boundary conditions appropriate to the infinite medium of fermions are employed. Approximations to these equations are made which lead to a generalized Brueckner reaction matrix formalism in the case of nuclear matter and which lead to an expression for the correlation energy in the case of the electron gas. The approximations for the system of nuclear matter are of three types: Ones which neglect the simultaneous interaction of three or more nucleons, the effective interactions of the vacant states below Fermi sea, and the self-energy interactions with excited nucleons. The relationship between the reaction matrix and the expectation value of the actual potential energy is discussed. It is found that the energy levels given by the Brueckner formalism are nearly those given by a consideration of the actual energy, thus indicating that the shell model energy levels for closed-shell-plus-one nuclei should be almost correct. A formula for the momentum distribution of nucleons in nuclear matter is obtained. (auth)

16002

THE ANALYTICAL PROPERTIES OF THE AMPLITUDE OF A PROCESS INVOLVING A VARIABLE NUMBER OF PARTICLES. A. A. Logunov and A. N. Tavkhelidze (Joint Inst. of Nuclear Research). Doklady Akad. Nauk S.S.S.R. 120, 739-42(1958) June 1. (In Russian)

A double Compton effect on nucleons was evolved in the integration of dispersion relations for processes with variable numbers of particles in the case where nonobserved energy-range is absent (integration was made with observed range of energies.) (R.V.J.)

16003

ON NON-LINEAR THEORY OF ELEMENTARY PARTICLES. D. Ivanenko and A. Brodskii (Lomonosov Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 120, 995-8(1958) June 11. (In Russian)

The nonlinear generalization of the Dirac equation for a quantum spinor field was investigated. The method of contraction, consisting of the identification of all spinor fields in the expression of two fermion pair interactions (as in the β-decay theory), was used to form the invariants. Universal fermion interactions and description of matter by a single world spinor is the principle of the method. (R.V.J.)

16004

ON EXACT SOLUTIONS OF ONE DIMENSIONAL FLOW EQUATIONS OF MAGNETO-GASDYNAMICS. S. I. Pai (Univ. of Maryland, College Park). IX^{e} Congr. intern. Mécan. Appl. 3, 17-25(1957).

The magneto-gasdynamic equations describing the steady, one-dimensional flow of a viscous, heat conducting, electrically conducting, and compressible gas under planar magnetic field perpendicular to the velocity vector are treated. First the generalized Rankine-Hugoniot relations are discussed. It was found that above an upper critical value of magnetic field h_c, no compression shock will occur even though the flow is supersonic in ordinary sense. Actually the sound speed in the present case depends on the magnetic field. A simple formula for the effective sound speed is obtained. At the critical magnetic field, the effective Mach number (flow velocity/effective sound speed) is unity and above the critical magnetic field, the effective Mach number will be less than one. The transition regions connecting the two uniform states defined by the generalized Rankine-Hugoniot relations are discussed under various conditions. It was found that there is a lower critical magnetic field $h_b (0 < h_b < h_c)$. When the magnetic field in front of the shock h_1 is smaller than h_b, sharp transition region, shock front, will occur. If $h_c > h_1 > h_b$ no sharp transition will occur but there will be a wide transition region. Finally $h_1 \geq h_c$ only possible solution will be a uniform stream. (auth)

16005

SOME MAGNETO-HYDRODYNAMIC MOVEMENTS IN A CYLINDRICAL FLUID MASS IN ROTATION WHICH AFFECT COSMOGONY. Cataldo Agostinelli. IX^{e} Congr. intern. Mécan. Appl. 3, 37-41(1957). (In French)

Equations are given which described the movement of an infinitely cylindrical, electrically conducting, homogeneous liquid mass which is rotating around an axis whose components of velocity and magnetic field are dependent on the length of the axis, on the anomaly and on the time, but not on the axial coördinate. (J.S.R.)

16006

MAGNETO-HYDRODYNAMIC WAVES IN A CIRCULAR CYLINDRICAL INCOMPRESSIBLE FLUID MASS. Cataldo Agostinelli. IX^{e} Congr. intern. Mécan. Appl. 3, 42-5(1957). (In French)

Equations are given describing the propagation of a magneto-hydrodynamic wave, of a given frequency, in the axial direction in a conducting, incompressible, viscous fluid mass which is contained in an infinite circular cylindrical tube and placed in a uniform magnetic field along the axis of the tube. (J.S.R.)

16007

ONE-DIMENSIONAL SIMPLE-WAVE FLOWS OF MAGNETO HYDRODYNAMICS. O. G. Owens (Sandia Corp., Albuquerque, N. Mex.). IX^{e} Congr. intern. Mécan. Appl. 3, 46-7(1957).

The equations describing an electrically conducting medium with constant entropy, vanishing mean-charge density and Maxwell displacement current, and an infinite electrical conductivity are solved under the hypothesis that the flow is one-dimensional, the magnetic and velocity vector fields have vanishing y components, and the flow has the equation of state, the pressure $P = P(\rho)$, where ρ is the mass density. (J.S.R.)

16008

ONE DIMENSIONAL SIMPLE WAVE FLOWS OF MAGNETO-HYDRODYNAMICS. O. G. Owens (Sandia Corp., Albuquerque, N. Mex.). IX^{e} Congr. intern. Mécan. Appl. 3, 47-8(1957).

The equations describing an electrically conducting medium with constant entropy, vanishing mean-charge

density, and known scalar electrical conductivity are solved under the hypothesis that the flow is one-dimensional, the magnetic and velocity vector fields have vanishing y components, the electric field has vanishing x and z components, and the flow has the equation of state, the pressure $P = P(\rho)$, where ρ is the mass density. (J.S.R.)

16009

CALCULATION OF THE EIGENVALUES OF THE ELASTIC COLLISION OPERATOR OF A LORENTZ GAS. STUDY OF SOME COMMON CASES. A. Arsac, L. Basquin, J. F. Denisse, et al. (Commissariat à l'Énergie Atomique, Paris). J. phys. radium 19, 624-9(1958) July. (In French)

The calculation of the first eigenvalues of the elastic collision operator in a Lorentzian gas for different types of interaction is given. The numerical processes which permitted these eigenvalues to be obtained are expanded. (tr-auth)

16010

STUDY OF THE FINE STRUCTURE OF THE DIFFUSION CURVES OF ELECTROMAGNETIC WAVES BY DIELECTRIC SPHERES. Jean Mevel (Faculté des Sciences de Rennes, France). J. phys. radium 19, 630-6(1958) July. (In French)

Recent theoretical computations of the light extinction curve by dielectric spheres have shown that it has, superposed on the major oscillations, very rapid fluctuations of small amplitude. This feature has not been explained. In this work, it is shown that these fluctuations result from resonances of multipole terms which form the scattered radiation and the origin of each of these secondary maxima is interpreted. A new theorem which gives the amplitude of the multipole modes is shown, and from this, the positions and intensities of the detailed structure are computed. Finally, it is shown that the present known extinction curve is not correct and the manner in which it must be modified is indicated. (tr-auth)

16011

GUIDED PROPAGATION OF ELECTROMAGNETIC WAVES IN A GYROELECTRIC ELECTRONIC PLASMA. B. Unal and Théo Kahan (Inst. Henri-Poincaré, Paris). J. phys. radium 19, 637-8(1958) July. (In French)

A partial differential equation of the fourth order is derived which describes the electromagnetic wave propagation in a wave guide filled with a magneto-plasma. (tr-auth)

16012

PARTICLES AND SYMMETRIES. E. Corinaldesi (Univ. Coll. of North Staffordshire, Keele, Eng.). Nuclear Phys. 7, 305-72(1958) July (1).

This work on "Particles and Symmetries" consists of 66 pages divided into 7 chapters. In addition to the introductory chapter the following chapter headings are listed: Space Inversion, Particle-Antiparticle Conjugation, Charge Symmetry, Time Reversal, Weak Interactions, and New Particles. The equations used in the treatment of the various particle states are developed. (A.C.)

16013

DIRAC MATRICES, TELEPARALLELISM AND PARITY CONSERVATION. H. S. Green (Univ. of Adelaide). Nuclear Phys. 7, 373-83(1958) July (1).

A proposal of Green and Hurst for reconciling failures of parity conservation is placed on a more fundamental basis. It is shown that teleparallelism is a necessary consequence of the introduction of Dirac matrices in general relativity, and that these matrices require a reducible 8-dimensional representation. A suggestion is made for the representation of all fermion fields by a single spinor. The problem of particle-antiparticle conjugation is solved for general relativity. Finally it is shown how the formalism introduced by Green and Hurst, and Watanable, is contained in the theory. (auth)

16014

BOUND STATES OF A MANY-PARTICLE SYSTEM. F. Coester (State Univ. of Iowa, Iowa City). Nuclear Phys. 7, 421-4(1958) July (1).

Rigorous formal solutions of the bound state Schrödinger equation are constructed in terms of an arbitary complete set of single particle wave functions. From these solutions one sees that the Rayleigh Schrödinger perturbation expansion of the energy does not contain matrix elements represented by products of unlinked diagrams. The components of the state vector are related in a simple manner to functions represented by linked diagrams only. (auth)

16015

ANALYTIC PROPERTIES OF THE SCATTERING MATRIX. T. Regge (Univ. of Turin and Istituto Nazionale di Fisica Nucleare, Turin). Nuovo cimento (10) 8, 671-9(1958) June 1.

The discussion of the behavior of the S-matrix is carried out on the basis of the modern theory of entire analytic functions for S waves and for a spinless particle scattered by a fixed spherical potential. It is shown that many of the properties of Jost's f(k) functions can be derived quite rigorously and simply, from very general theorems. Among them we point out a theorem on the existence of infinite zeros of f(k) when the potential decreases fast enough to make f(k) regular in the whole plane of k. The asymptotic behavior of the distribution of these zeros is also discussed. (auth)

16016

THE THEORY OF RELATIVITY, THE ELECTROMAGNETIC THEORY AND THE QUANTUM THEORY. H. T. Flint (Univ. of London) and E. M. Williamson (St. Mary's Coll., Durham, Eng.). Nuovo cimento (10) 8, 680-98 (1958) June 1.

It is shown that it is possible, by means of geometry and the introduction of a principle of measurement, founded by analogy with the theory of H. Weyl, to discover a unity existing between gravitational, electromagnetic, and quantum phenomena. Dirac's equation and an extension of it are derived from the principle of measurement. An essential feature of the theory is that it incorporates a theory of the electron in which its mass appears as a geometrical quantity, entering into the equation as a consequence of the existence of a fundamental unit of length. The observed mass is given by this geometrical mass together with interaction terms which also enter naturally into the theory. (auth)

16017

EXACT DETERMINATION OF A PHENOMENOLOGICAL SEPARABLE INTERACTION. M. Gourdin and A. Martin (Laboratoire de Physique, Ecole Normale Supérieure, Paris). Nuovo cimento (10) 8, 699-707(1958) June 1.

The method of Muskhelishvili applied by Omnes to the problem of one meson production by mesons is used to solve the integral equation determining a phenomenological separable interaction from the energy dependence of an experimental phase shift in a collision problem. The interaction in momentum space is given by an expression containing only one integral. The results obtained in a previous paper concerning the existence and multiplicity of the solutions are confirmed. The method

is checked by an explicit calculation in the case when the phase shift is exactly given by the shape independent approximation. (auth)

16018

MASS REVERSAL AND LEPTON PROCESSES. T. Ouchi, K. Senba, and M. Yonezawa (Hiroshima Univ.). Nuovo cimento (10) 8, 708-16(1958) June 1.

It is shown that the special mass reversals MR(1) and MR(2) can be applied to Fermi type interactions without any internal contradiction in the theory. The selection rules obtained are consistent with the experiments. This suggests to take the universal Fermi interactions as the most probable primary interactions for all the weak interactions. From the mass reversibility of the theory under MR(1), it is concluded that the space parity is not conserved in all the weak interactions, and all the lepton processes must involve at least one neutrino whose mass must be exactly zero. From the requirement of MR(2), either a linear combination of (STP) couplings or a linear combination of (AV) couplings is shown to be allowed. The theory admits an interesting case that one can introduce two neutrinos which can play a similar role as "Twin" neutrinos, and the baryons are conserved automatically. (auth)

16019

ABOUT A CERTAIN METHOD FOR FINDING THE ASYMPTOTIC PHASES. T. Tietz (The Univ., Lodz, Poland). Nuovo cimento (10) 8, 765-6(1958) June 1.

Starting with the radial wave equation for scattering with a Coulomb potential, a formula is derived which yields the asymptotic phase $N_{\mu,l}$ if the zero r_0 of $R_l(r)$ is known. The method is very accurate. (D.E.B.)

16020

SOME ASPECTS OF THE COVARIANT FUNCTIONAL FORMALISM OF FIELD THEORY. II. R. S. Liotta (Univ. of Rome and Istituto Nazionale di Fisica Nucleare, Rome). Nuovo cimento (10) 8, 798-806(1958) June 16.

Hamilton's covariant equations for an electromagnetic field in the presence of a given current are written based on a previous work. The Jacobi equation is written such that it defines a class of canonical transformations which conserve the true covariance of the scheme. By means of a proper introduction of covariant functional operators, the Tomonaga equation is written such that it is covariant independently of the particular choice of canonical variables, and, hence, is covariant even in the Schrödinger representation. It is shown by means of a generalization of the W.K.B. method that under certain assumptions the Tomonaga equation reduces to the classical Jacobi equation. (auth)

16021

BASIC EQUATIONS OF RELATIVISTIC MECHANICS OF A REAL POINT WITH VARIABLE MASS. N. S. Kalitzin (Bulgarischen Akademie der Wissenschaften, Sofia, Bulgaria). Nuovo cimento (10) 8, 843-9(1958) June 16. (In German)

The equations of a real point with variable mass were generalized for relativistic velocities. The general case in which the mass defect of the point is different from zero is treated. Some applications of the basic equations are given, especially a universal form is given for the case of the "pure" rocket. (tr-auth)

16022

LIMITS ON COUPLING CONSTANTS IN FIELD THEORIES WITH FINITE SOURCES. M. A. Ruderman (Univ. of Rome) and S. Gasiorowicz (Univ. of Copenhagen). Nuovo cimento (10) 8, 861-77(1958) June 16.

The interaction of a boson field with a source is assumed to vanish outside of a radius α; no special properties are assumed for this source within the radius. It is shown that with such a model for the interaction of pions or K mesons with nucleons and hyperons, rigorous upper limits, depending only upon α and the particle masses, can be established for the renormalized coupling constants $g^2_{\Lambda\Sigma\pi}$, $g^2_{p\Sigma K}$, and $g^2_{p\Lambda K}$ corresponding to the matrix elements for the processes $\pi + \Lambda^0 \rightarrow \Sigma$, $\bar{K} + p \rightarrow \Sigma$, and $K^- + p \rightarrow \Lambda^0$. For the pion nucleon interaction a maximum $g^2_{np\pi}$ is found, above which there must exist a doubly charged state of the system $\pi^+ + p$. If $g^2_{np\pi}$ does approach infinity or if α approaches zero, it is proved that the neutron-proton mass difference goes to zero independently of other interactions or whether the bare masses are identical. Similar results hold for the mass difference of any baryon pair if they transform into each other by single boson emission or absorption. A general class of field theory models, which will always have "ghosts", is described. (auth)

16023

ON WEAK INTERACTIONS OF ELEMENTARY PARTICLES. B. d'Espagnat (CERN, Geneva). Nuovo cimento (10) 8, 894-8(1958) June 16.

A transformation similar to the one proposed by Pauli is suggested for the description of 4-vectors rotations in a Euclidian [4] space. Specializing these rotations to rotations in "M" space in the way described by several authors, one is led to a general description of weak interactions which, though rather similar to the one previously studied, nevertheless presents some significant new features, and seems freer from ad hoc assumptions. (auth)

16024

A SIMPLE FORMULATION OF THE ELEMENTARY PARTICLE SCHEME OF GELL-MANN AND NISHIJIMA. M. Kretzschmar (Univ. of Göttingen, Germany). Nuovo cimento (10) 8, 949-50(1958) June 16.

For all elementary particles the quantum numbers N (baryon), Q (electrical charge), and U (hypercharge) fulfill the conditions $\{N\} \leq 1$, $\{Q\} \leq 1$, $\{U\} \leq 1$, and $Q \times U \geq 0$. A particle is a fermion or a boson if $N = \pm 1$ or $N = 0$. If Λ^0 and its antiparticle $\bar{\Lambda}^0$ are considered separately, then a one to one correspondence is established between elementary particles which occur in nature and those sets which satisfy $\{N\} \leq 1$, $\{Q\} \leq 1$, $\{U\} \leq 1$, and $Q \times U \geq 0$. These relations contain all information that the Gell-Mann-Nishijima scheme gives about those combinations of baryon number, electrical charge, strangeness, spin, and isobaric spin which are realized in nature. (W.D.M.)

16025

ON THE UNITARITY OF THE S-MATRIX IN QUANTUM FIELD THEORIES WITH INDEFINITE METRIC. R. Ascoli (Univ. of Turin and Istituto Nazionale di Fisica Nucleare, Turin) and E. Minardi (Societa Nazionale Cogne, Aosta, Italy and Istituto Nazionale di Fisica Nucleare, Turin). Nuovo cimento (10) 8, 951-3(1958) June 16.

The possibility of getting a unitary S matrix and of having conservation of scattering probability in a theory with indefinite metric was investigated. A theorem is proposed and a general proof given. (W.D.M.)

16026

CONVERGENCE OF THE METHOD OF MOMENTS. Francis R. Halpern (Princeton Univ., N. J.). Phys. Rev. 111, 1-2(1958) July 1.

A proof is given that the nth approximation of the method of moments is convergent when applied to the polaron problem. (auth)

16027

POSSIBILITY OF FORMULATION OF A THEORY OF STRONGLY INTERACTING FERMIONS. A. A. Abrikosov, A. D. Galanin, L. P. Gorkov, L. D. Landau, I. Ya. Pomeranchuk, and K. A. Ter-Martirosyan (Academy of Sciences of USSR., Moscow). Phys. Rev. 111, 321-8(1958) July 1.

A fermion field is investigated with the interaction Lagrangian density equal to $g(\Psi O_j \psi) \cdot (\Psi O_j \psi)$. This point interaction is considered as a limit of an extended one, where it is supposed that the interaction vanishes if the momentum of a particle exceeds Λ and/or if the momentum transferred in a collision of two particles exceeds λ. The relation between Λ and λ is such as to make the quantity $\lambda^2/\ln(\Lambda/\lambda)$ arbitrarily small as $\lambda \to \infty$ and $\Lambda \to \infty$. This choice of the limiting procedure considerably simplifies the investigation of the theory. It is shown that in the limit $\lambda \to \infty$, $\Lambda \to \infty$, the physical interaction between particles vanishes in all types of four-fermion interactions. The case of two interacting fields ψ and χ with different isotopic spin is also considered. Going over to the local theory, the physical interaction vanishes in this case as well. This result shows that in the cases considered no strongly interacting fermion theory can be constructed. In the case of the weak interaction, although no logically consistent theory can be built up, there does exist the perturbation theory, as in electrodynamics, which is valid for sufficiently small energies. (auth.)

16028

QUANTIZATION PROCESS FOR MASSLESS PARTICLES. C. L. Hammer and R. H. Good, Jr. (Iowa State Coll., Ames). Phys. Rev. 111, 342-5(1958) July 1.

The quantization of a recently proposed theory for particles of arbitrary spin and zero mass is given. An interesting result is that there is a connection between the spin and the statistics of the particles. It is found that the spinor components of a boson/fermion field with integral/half-integral spin commute/anticommute off of the light cone whereas the spinor components of a boson/fermion field with half-integral/integral spin do not. As in the unquantized theory, the two-component neutrino and the photon are special cases. (auth)

16029

FIELD THEORY OF DEUTERON EXCHANGE CURRENTS. Lee M. Frantz (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 111, 346-53(1958) July 1.

The influence of pion exchange currents on the thermal capture process ($n + p \to d + \gamma$) is investigated field-theoretically. The Chew model is used for the pion-nucleon interaction, and perturbation and corresponding renormalization techniques are developed for treating a system containing two dynamic nucleons. The Fock-space state vector is related to the two-nucleon wave function, and the cross section is then calculated to order ef^2. The observed cross section is known to be somewhat larger than that predicted neglecting explicit meson effects, and it is found that the contribution of the exchange currents is too small and of the wrong sign to account for the discrepancy. (auth)

16030

FORM FACTORS IN β DECAY AND μ CAPTURE. M. L. Goldberger and S. B. Treiman (Princeton Univ., N. J.). Phys. Rev. 111, 354-61(1958) July 1.

It is supposed that β decay and μ capture are described by a universal vector and axial vector Lagrangian, and the properties of the corresponding S-matrix elements are considered. Owing to the strong interactions of the nucleons, the structure of the S matrix is expected to be more complicated than that of the Lagrangian. In the former, vector and axial vector terms appear, but with coefficients which in general depend on the invariant nucleon momentum transfer; they can be thought of as Fermi interaction form factors. Moreover, two additional kinds of terms can appear in the S-matrix elements: one which simulates a direct pseudoscalar coupling and one which simulates a direct coupling involving derivatives of the nucleon wave functions. The latter is probably too small to have any experimental significance. The former, though negligible in β decay, may be appreciable in μ capture. The effective pseudoscalar coupling coefficient is estimated to be about eight times as large as the axial vector coefficient. More generally, the structure of the various form factors is investigated. A recent quantitative discussion which has been given of $\pi \to \mu + \nu$ decay is also considered. (auth)

16031

TEST OF THE NATURE OF THE VECTOR INTERACTION IN β DECAY. Murray Gell-Mann (Calif. Inst. of Tech., Pasadena). Phys. Rev. 111, 362-5(1958) July 1.

An experiment is proposed to test the theory recently advanced by Feynman and Gell-Mann on the vector interaction in β decay. According to the theory, the Fermi coupling constant is not appreciably altered by renormalization, in agreement with experiment. A further property of the theory is exploited here, that analogous γ and β transitions in light nuclei have proportional matrix elements, as far as the V interaction is concerned. In particular, the V interaction gives rise to "weak magnetism" analogous to the magnetic effects that induce the emission of M1 photons. This "weak magnetism" obeys Gamow-Teller selection rules and interferes with the A coupling, distorting the spectra of high-energy β transitions with $\Delta J = 1$ (no). It is suggested that the β spectra of B^{12} and N^{12} be measured accurately and compared. Departure from linearity of the Kurie plot should be noticed in each case; the ratio of the spectra can be calculated with confidence on the basis of the theory, which predicts a 20% effect. The measured γ-ray width of the 15.11-Mev state in C^{12} is used in the calculation. (auth)

16032

SIMPLE APPROXIMATION FOR THE NON-UNIQUE FIRST FORBIDDEN TRANSITION. Tsuneyuki Kotani and Marc Ross (Indiana Univ., Bloomington). Phys. Rev. Letters 1, 140-2(1958) Aug. 15.

The accuracy of the approximation of keeping only the leading terms in powers of ρ in the equation $\xi = \alpha Z/2\rho \approx Z/A^{1/3}$ is examined, and its consequences are shown for other observables such as the longitudinal polarization and β-γ correlations. (W.D.M.)

16033

CONJECTURE CONCERNING THE PROPERTIES OF NONRENORMALIZABLE FIELD THEORIES. Peter J. Redmond and Jack L. Uretsky (Univ. of California, Berkeley). Phys. Rev. Letters 1, 147-8(1958) Aug. 15.

A mathematical model is proposed to show that it is possible to perform calculations with a local nonrenormalizable field theory and that nonrenormalizable interactions may have physical significance. (W.D.M.)

16034

MANY-BODY PSEUDOPOTENTIAL FOR HARD-SPHERE INTERACTION. Ryuzo Abe (Tokyo Inst. of Tech.). Progr. Theoret. Phys. (Kyoto) 19, 1-16(1958) Jan.

A many-body pseudopotential for a hard-sphere system which is mathematically equivalent to the boundary conditions imposed on the wave functions is obtained as a generalization of Huang and Yang's binary pseudopotential, and the lowest order term of the ground state energy resulting from the triple collision is calculated for the Bose system. Instead of the direct perturbational treatment of the pseudopotential, the use of the ρ_k-representation for the Bose system is proposed, and the ground state energy is calculated in this representation. It is shown that the energy thus calculated is of the form of an expansion in powers of $(\rho a^3)^{1/2}$, where ρ is the average density and a the hard-sphere diameter, which is in agreement with Lee and Yang's conclusion drawn from the binary collision expansion method. Some discussions associated with the roton spectrum of liquid He^4 are given. (auth)

16035

ON THE PROPAGATION OF THE HYDROMAGNETIC WAVES IN COMPRESSIBLE IONIZED FLUID. Tosiya Taniuti (Kobe Univ., Japan). Progr. Theoret. Phys. (Kyoto) 19, 69-76(1958) Jan.

A mathematical treatment of the wave propagation due to the coupled motion of hydrodynamic flow and magnetic field is given on the basis of the method of characteristics. Two simplifying assumptions are introduced: first the conductivity of the medium is infinite, and second, the effect of the electric displacement current may be neglected. Special consideration is given to the occurrence of shock waves in unidimensional motion. (auth)

16036

GENERAL THEORY OF INFRARED DIVERGENCE. Noboru Nakanishi (Kyoto Univ.). Progr. Theoret. Phys. (Kyoto) 19, 159-68(1958) Feb.

The problems of infrared divergence in perturbation theory are generally discussed, including not only photons but neutrinos which interact with other particles in various ways. A completely general proof of the cancellation of infrared divergence in each order is given, as previous works on this problem seem insufficient. (auth)

16037

REMARKS ON SPIN-WAVE THEORY FOR THE FERROMAGNETIC EXCHANGE PROBLEM. Isao Mannari (Kyoto Univ.). Progr. Theoret. Phys. (Kyoto) 19, 201-13(1958) Feb.

A theory which is essentially equivalent to Bloch-Bethe-Van Kranendonk's formalism is developed of the properties of an ideal ferromagnet with isotropic exchange coupling between nearest neighbor spins ½. Concerning the thermodynamic properties of the system at low temperatures far below the Curie point, a complete treatment is obtained. In this temperature region the excitation of the system is naturally described in terms of spin waves which obey Fermi-Dirac statistics. Interactions between spin waves are discussed in the scheme of the second quantization, and their effects on the spontaneous magnetization are also discussed. (auth)

16038

ON THE APPLICABILITY OF THE PION-THEORETICAL NUCLEAR POTENTIAL. Shoichiro Otsuki (Nagoya Univ., Japan); Ryozo Tamagaki (Kyoto Univ.); and Wataro Watari (Osaka City Univ.). Progr. Theoret. Phys. (Kyoto) 19, 217-19(1958) Feb.

In phenomena of nuclear forces, the agreement between experiment and pion theory is very satisfactory at energies below at least 20 Mev. At higher energies, however, the situation has not been well clarified, though quantitative agreement has already been obtained up to about 100 Mev. It appears that the scattering phenomena around 100 Mev may lie within the applicability of the low-energy pion theory. (A.C.)

Uranium and Uranium Compounds

16039

STRUCTURAL RELATIONS OF UO_2, ISOMETRIC $PbUO_4$ AND ORTHORHOMBIC $PbUO_4$. Clifford Frondel and Ivan Barnes (Harvard Univ., Cambridge, Mass.). Acta Cryst. 11, 562-3(1958) Aug.

Isomeric and orthorhombic $PbUO_4$ was synthesized by heating U_3O_8 with PbO and excess sheet lead in water at 230 to 290°C. Both substances contain U^{6+} and the formula is more properly written $Pb(UO_2)O_2$. The isometric polymorph is isostructural with UO_2 with A_0 = 5.600 ± 0.002 A. Orthorhombic $PbUO_4$ is isostructural with $BaUO_4$ with A_0 = 5.528, b_0 = 7.952, and c_0 = 8.180 A. Tables of spectral data are included. (D.E.B.)

16040

SOME CYCLES OF URANIUM FABRICATION. Michel Brodsky. Énergie nucléaire 2, 110-15(1958) Apr.-June. (In French)

The unusual aspects of the evolution of the uranium industry are reviewed. The necessity of incorporating this industry into the economic cycle by seeking to reduce the expense and by fixing a price on uranium metal is discussed. The diverse operations which the fabrication of uranium require are analyzed with respect to resolving the cost factors. Certain new operations which could be of economic interest are indicated. (tr-auth)

16041

MELTING POINT AND SPECTRAL EMISSIVITY OF URANIUM DIOXIDE. Thomas C. Ehlert and John L. Margrave (Univ. of Wisconsin, Madison). J. Am. Ceram. Soc. 41, 330(1958) Aug.

Small pieces of pure UO_2 supported on 0.090-in.-diam. tungsten wire were melted in vacuum with a 15-kw induction heater. By comparison with the tungsten surface the spectral emissivity of the polished UO_2 surface at 6500 a.u. was found to be 0.416 ± 0.026 within at least 100°C of the melting point of UO_2. Using a different method, the spectral emissivity of solid UO_2 and of powdered UO_2 at 6500 a.u. was found to be 0.40 ± 0.02 and 0.51 ± 0.03, respectively, between 1800 and 2100°C. The UO_2 began to melt at 2512 ± 13°C, brightness temperature. UO_2 did not melt at 2477 ± 13°C, brightness temperature, and melting occurred readily at 2542 ± 13°C, brightness temperature. Thus, the melting point of UO_2 was found to be 2860 ± 45°C, true temperature. Powdered UO_2 could be sintered at temperatures as low as 2310°C. (L.T.W.)

16042

A COMPRESSIVE CREEP TEST OF ALPHA-URANIUM UNDER NEUTRON IRRADIATION. H. C. Rose (Central Electricity Authority Research Labs., Leatherhead, Surrey, Eng.). J. Inst. Metals 86, 122-8(1957) Nov.

An apparatus was designed and constructed for measuring the compressive creep of uranium during irradiation in a Windscale pile; in particular, the behavior of α-uranium at 450°C. under a stress of 2.7 tons/in.^{2} was studied. The first results show that irradiation does not appreciably affect the secondary creep rate at this temperature. A transient increase in creep rate, which may be due to thermal cycling, was observed on pile start-up after cooling down between creep runs. (auth)

PATENTS

Biology

16043

CLEANING COMPOSITIONS FOR SURFACES CONTAMINATED WITH HEAVY METAL COMPOUNDS. E. A. Saxon-Napier (to Brentford Soap Co., Ltd.). British Patent 790,306. Nuclear Eng. 3, 360(1958) Aug.

Deposits of radioactive materials on laboratory and industrial equipment, clothing, and human skin can be removed by an aqueous cleansing cream comprising an alkali metal salt of a polyaminopolycarboxylic acid complexing agent, or of an alkaline earth metal complex thereof, water and a water-soluble polymer known to give aqueous solutions of high viscosity. The composition is first put on the surfaces to be cleaned, which are then flushed with water until the cream has been removed.

Chemistry

16044

PROCESS FOR THE FLUORINATION OF ORGANIC COMPOUNDS. (to U. K. Atomic Energy Authority). British Patent 789,441. Nuclear Eng. 3, 360(1958) Aug.

The organic compounds are aliphatic hydrocarbons or their partial fluorination products. The compound is fed in the vapor state to a reaction zone in which finely divided cobalt trifluoride is maintained at fluorinating temperature in fluidized condition. Fluorination of the compound and conversion of the trifluoride to difluoride occur. The cobalt difluoride is separated and reacted with free fluorine in gaseous form to regenerate the trifluoride, with which then further quantities of the aliphatic hydrocarbon are reacted.

16045

BERYLLIUM HYDROXIDE. (to Pechiney Compagnie de Products Chimiques et Electrométallurgiques (France)). British Patent 788, 383. Nuclear Eng. 3, 314(1958) July.

It is often advisable to use beryllium hydroxide as an intermediate product when preparing beryllium oxide, or a salt of beryllium. It has now been found that there is a possibility of directly precipitating beryllium hydroxide, in the β form, from a solution of a beryllium salt by neutralizing the solution with an alkali base (ammonia) under controlled conditions of pH (between 6 and 8.5) and of temperature (80°C and boiling). Hydroxide ready precipitated may act as seed.

16046

PRODUCTION OF DENSER GRAPHITE. G. H. Greenhalgh (to U. K. Atomic Energy Authority). British Patent 789,663. Nuclear Eng. 3, 360(1958) Aug.

The production of electrodes of artificial graphite where density is important because of reduced power consumption, breakage, and rate of wear is described. The dense graphite is prepared by heating a mass of calcined carbonaceous material free from sulfur, nitrogen, and oxygen to a graphitizing temperature of 2,200° to 2,700°C.

16047

PREPARATION OF DI-POTASSIUM URANOUS FLUORIDE. (to U. K. Atomic Energy Authority (U.S.A.)). British Patent 790,296. Nuclear Eng. 3, 360(1958) Aug.

A process is described whereby uranous oxide is heated at about 800°C with potassium acid fluoride for the production of di-potassium uranous fluoride.

16048

EXTRACTION OF PLUTONIUM FROM AQUEOUS SOLUTION. A. G. Maddock and A. H. Booth. British Patent 790,041. Nuclear Eng. 3, 360(1958) Aug.

Plutonium can be extracted from aqueous solutions containing oxalate by treating the solution with cupferron so as to form a complex of plutonium and cupferron, which is extracted by a water-immiscible organic solvent. Plutonium may thus be obtained from the organic solvent phase by standard methods. A very convenient method is based on the photo-instability of cupferron; the solvent phase is subjected to light and the plutonium resulting from decomposition of cupferron complex washed out with dilute mineral acid.

16049

SEPARATION OF ZIRCONIUM AND HAFNIUM COMPOUNDS. R. B. Eaton (to E. I. Du Pont de Nemours and Co.). British Patent 790,345. Nuclear Eng. 3, 360(1958) Aug.

Zirconium and hafnium halides are separated from vaporous mixtures by contacting the mixed halide vapors with a solvent consisting of molten alkali metal halide, followed by fractionation.

Mineralogy, Metallurgy, and Ceramics

16050

ELECTRODEPOSITION OF TITANIUM, ZIRCONIUM, HAFNIUM, TANTALUM, VANADIUM, NIOBIUM, CHROMIUM, MOLYBDENUM AND TUNGSTEN. (to Horizons Titanium Corp., (U.S.A.)). British Patent 788,295. Nuclear Eng. 3, 314(1958) July.

It has been found that when cladding base metals with corrosion resistant metals by electrolysis in a fused salt bath alloying takes place between the deposited metal and the base cathode metal on using a combination of a specific range of higher bath temperatures and a specific range of cathode current densities.

16051

FORMATION OF HARD INTERMETALLIC COATINGS FROM ELECTRO-DEPOSITED LAYERS OF TITANIUM, ZIRCONIUM, HAFNIUM, VANADIUM, NIOBIUM, TANTALUM, CHROMIUM, MOLYBDENUM AND TUNGSTEN. (to Horizons, Inc., (U.S.A.)). British Patent 788,804. Nuclear Eng. 3, 314(1958) Juy.

A cladding layer of the refractory metal is formed on the base metal. Either simultaneously or subsequently a transfer of a refractory metal-hardening element from the mass of the base metal to the cladding layer of the refractory metal is effected. A fused salt bath is used, composed essentially of a halide of the refractory element and a diluent halide salt. The base metal incorporating the intermetallic compound-forming element (carbon, nitrogen, boron or silicon) is immersed in the bath as the cathode of an electrolytic cell. After deposition of a layer of the refractory metal on the cathode, the cathode is heated sufficiently to effect thermal diffusion of the intermetallic compound-forming element from the base metal into the refractory layer.

16052

PURIFICATION OF THORIUM. R. Lind and T. A. Ingles (to U. K. Atomic Energy Authority). British Patent 789,894. Nuclear Eng. 3, 360(1958) Aug.

The impure thorium compound mixed with carbon and formed into pellets or briquettes is chlorinated in the lower part of a vertical silica column at 850 to 920°C. The part is closed by a silica grill which supports a

fractionating packing, ceramic material or porous carbon, and a condensing surface. Thorium tetrachloride of enhanced purity is obtained.

16053

ELECTROPLATING PROTECTIVE METAL COATINGS ON URANIUM METAL. (to Atomic Energy of Canada, Ltd., (Canada)). British Patent 788,838. Nuclear Eng. 3, 314(1958) July.

The uranium is subjected to anodic treatment in an aqueous bath containing carboxylic radicals to ensure a surface free from oxide and pitting.

16054

PRODUCTION OF HEAT AND CORROSION RESISTANT BODIES. A. Blainey (to U. K. Atomic Energy Authority). British Patent 788,926. Nuclear Eng. 3, 314(1958) July.

The use of aluminium as a covering for uranium rods does not permit higher temperatures of operation of thermal fission reactors. Relatively high temperatures, however, can be reached when using beryllium or zirconium for enclosing uranium and/or thorium. The constituent materials are formed into elements or units to the cross-sections required by powder metallurgy which permits the use of substances of small neutron capture cross-section in a non-ductile state. Thick sheaths are thus tolerable, good contact can be secured in a simple manner, accurate machining of uranium metal and drawing of metal tubes can be dispensed with, and the closure of the sheath can be effected during manufacture.

16055

CANNING OF METALS. A. B. McIntosh and K. Q. Bagley (to U. K. Atomic Energy Authority). British Patent 790,334. Nuclear Eng. 3, 360(1958) Aug.

Instead of using metals resistant to the action of uranium, plutonium, and thorium for canning these fuels in nuclear reactors, a close fitting envelope is made of metal, not necessarily inert towards the contained metal at temperatures below 800°C, over a thin interlayer of niobium metal between envelope and fuel. The interlayer, 1 to 2 mils thickness, may be formed either on the fuel metal or on the envelope or on both by electrodeposition, evaporation, metal spraying, or other means, or the niobium may be wrapped around as a foil. After applying the layer and sealing the envelope the assembly is subjected to pressure for close contact.

Physics

16056

NUCLEAR REACTORS. (to Stiching Reactor Centrum Nederland (Netherlands)). British Patent 788,284. Nuclear Eng. 3, 314(1958) July.

In the reactor, one or more bodies of porous material are provided in the reaction zone consisting of an intimate mixture of fuel, moderator, and heat distributing material. The fissile material is not present as metal but is distributed throughout the porous material formed by a sintering process. The gaseous fluid is pumped through the reaction zone under pressure. Core temperatures of 600 to 1500°C are attainable. (W.D.M.)

16057

IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. J. Diamond and S. G. Bauer (to United Kingdom Atomic Energy Authority). June 25, 1958. British Patent 796,992. Nuclear Power 3, 394(1958) Aug.

A reactor made up from nine separate, self-contained units, each removable independently for servicing, is proposed. Each unit contains its own reactive section, heat exchanger, circulating pump, shields, and other components. (W.D.M.)

16058

FUEL ELEMENTS FOR NUCLEAR REACTORS. W. B. Hall and T. Davis (to U. K. Atomic Energy Authority). British Patent 789,257. Nuclear Eng. 3, 360(1958) Aug.

With higher heat ratings in thermal reactors having deep-finned elements to conduct a higher heat flux, there is an increase in the temperature difference between root and tip of the fin so that the tip serves little purpose from a heat transfer aspect. Without the tip, less pumping power is needed. This leads to a design of rod-like or tube-like fuel elements shaped so as to be undulating in longitudinal section and enclosed in a protective sheath of constant cross section.

16059

IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. D. W. T. Angwin (to General Electric Co., Ltd.). May 28, 1958. British Patent 795,826. Nuclear Power 3, 348(1958) July.

By building the pressure vessel of a gas-cooled reactor of thick concrete, it could also form the whole or part of the biological shield. A thin metallic lining is incorporated to prevent gas diffusion into the concrete and also to act as shuttering while the concrete is being cast. It is formed of a series of flanged plates initially bolted or clamped together during casting and finally seal welded along the outer edges. The idea is worked out for a cylindrical vessel but it is equally applicable to a spherical one.

16060

IMPROVEMENTS IN OR RELATING TO NUCLEAR POWER REACTORS. B. L. Goodlet (to United Kingdom Atomic Energy Authority). June 4, 1958. British Patent 796,164. Nuclear Power 3, 394(1958) Aug.

A reactor system claiming to combine the good heat transfer characteristics of a pressurized water reactor with the stability and lower operating pressures of a boiling water system is proposed. The coolant is water containing the minimum amount of steam and at a pressure not substantially above the saturation pressure at the operating temperature. This is achieved by having a free water surface in the pressure vessel. During normal running the evaporation from this is very small, but if there is an increase in reactivity the water temperature rises causing an increase in vapor pressure. This operates a safety valve leading to a blow-off condenser so that the temperature stabilizes. Condensate from the blow-off condenser may be returned to the pressure vessel to maintain the water level.

16061

IMPROVEMENTS IN OR RELATING TO TUBULAR FUEL ELEMENTS FOR NUCLEAR REACTORS. Henry Lloyd and Alan Blainey (to United Kingdom Atomic Energy Authority). May 14, 1958. British Patent 794,901. Nuclear Power 3, 348(1958) July.

One of the disadvantages of tubular fuel elements is that unequal dimensional changes occur due to temperature changes and irradiation effects. One sheath is brought into tighter contact with the fuel while the other makes poorer contact so that there is an unequal distribution of heat to the two cooling surfaces. To overcome this an element is described comprising a tube of beryllium with longitudinal bores containing uranium rods. The tube may be fluted on the inner and outer surfaces to equalize the thickness of metal between them. The fuel may be enclosed by a beryllium plug at each end, argon-arc welded into place. Alternatively, there may be an annular groove at the end of the tube and the seal formed by a beryllium ring welded to the groove wall.

16062

IMPROVEMENTS IN NUCLEAR REACTORS AND AN IMPROVED METHOD OF OPERATING NUCLEAR REACTORS. (to Babcock & Wilcox, Ltd.). Apr. 30, 1958. British Patent 794,329. Nuclear Power 3, 348(1958) July.

Instead of preventing the circulation of gaseous fission products in a gas-cooled reactor by canning the fuel elements, this is an idea for a reactor in which the poisons, notably xenon, are removed from the coolant chemically. Unsheathed fuel rods are inserted into vertical channels in the graphite moderator and pressurized carbon dioxide passed upwards over them in the usual way. The horizontal boiler has hemispherical ends and is divided by a partition so that the coolant flows in a U-shaped path. Part of the coolant is led off to a water-filled pressure vessel where the carbon-dioxide dissolves and the insoluble xenon with some CO_2 is blown off. The water is then passed through a throttling valve into another vessel with lower internal pressure and degasification takes place. Liberated CO_2 is returned by a compressor to the closed circuit passing through a freezer to remove water vapor. Only part of the coolant need be purified as a certain enrichment in xenon is permissible.

16063

IMPROVEMENTS IN AND RELATING TO NUCLEAR REACTORS. Harry Chilton (to C. A. Parsons and Co., Ltd.). June 25, 1958. British Patent 796,966. Nuclear Power 3, 394(1958) Aug.

The volume of water in boiling water reactors which has to be recirculated is considerable and difficult to handle, and requires the use of large pumps. To avoid the use of these and their associated difficulties, the natural circulation induced by the difference in density between the water and the water/steam mixture can be employed. Normally the available head in this method is relatively small, and the idea of this patent is to increase it. Nozzles are arranged at the inlet of some or all of the fuel ducts through which water is pumped at high speed, producing an injector effect which assists natural circulation. This water can either be drawn from the reactor vessel or obtained from the condensate from the turbines.

16064

METHOD OF TREATING MATERIALS WITH HIGH ENERGY PARTICLES. J. B. Birks (to British Dielectric Research, Ltd.). British Patent 789,456. Nuclear Eng. 3, 360(1958) Aug.

A first part of the particle beam impinges on one side of the body, a second part passes the body and enters a uniform magnetic field by which it is deflected back to impinge on the opposite side of the body. The magnetic field is arranged transversely to the direction of the beam and strong enough to cause the beam to be deflected through approximately 180° in a curved path. A particular application is the irradiation of an electric cable moving through the beam where penetration of the body is obstructed by the conductor.

16065

IMPROVEMENTS IN OR RELATING TO HEAT TRANSFER ARRANGEMENTS. D. A. Boyland (to General Electric Co., Ltd.). July 2, 1958. British Patent 797,608. Nuclear Power 3, 394(1958) Aug.

The helically finned can has a protective cylindrical sheath of thin metal making good thermal and gas tight contact with the fins. In it are a series of gas inlet holes and outlet holes on opposite sides of the element. Gas entering an inlet passes round the fin axially in both directions until it reaches the associated outlets. Thus by suitable disposition of the inlets and outlets, coolant can be made to pass round ½, 1½, 2½ or more turns of the helical channel, and by choice of spacing the cooling requirements may be satisfied and the gas temperature raised by the desired amount. The system could also be applied to cans with multistart fins and to fuel elements which are themselves in the form of a helix.

16066

BREEDER-CONVERTER NUCLEAR REACTOR AND METHOD OF MANUFACTURING FISSILE MATERIAL IN THE SAME. (to Babcock & Wilcox Co. (U.S.A.)). Apr. 23, 1958. British Patent 739,916. Nuclear Power 3, 348(1958) July.

The main design feature of this fast breeder, burning highly enriched U^{238} and heavy water cooled, is that the fertile fuel assemblies are interchangeable so that the maximum burn-up is achieved. Both fissionable and fertile fuel elements comprise a number of thin plates put together to form an assembly about six inches square and six feet long. Core and blanket are arranged in a right circular cylinder and fertile fuel is also dispersed regularly throughout the core. These central elements burn-up more quickly than the blanket and when refuelling takes place they are removed and assemblies from the blanket moved in to take their place.

16067

IMPROVEMENTS IN OR RELATING TO RETAINING DEVICES FOR FUEL ELEMENTS IN GAS-COOLED NUCLEAR REACTORS. (to United Kingdom Atomic Energy Authority). May 14, 1958. British Patent 794,981. Nuclear Power 3, 348(1958) July.

In a gas-cooled reactor with horizontal channels, the coolant pressure may be sufficient to expel the fuel elements. This design is for a retaining device for coupled strings of elements. The aluminum fuel cans are attached by circumferential wires to graphite carriers sliding in a groove in the channels. These carriers have a coupling hook at each end, mating with the adjacent one as each is pushed into the channel. The retaining device also has a hook which engages with the end element and it engages the reactor face by two cranks on pivots, locked in position by a gravity and spring biased rod. For discharging, pressure on the rod releases the retainer and the whole coupled string can be withdrawn.

16068

NUCLEAR REACTOR ARRANGEMENTS. P. A. Lindley (to General Electric Co., Ltd.). British Patent 789,482. Nuclear Eng. 3, 360(1958) Aug.

A gaseous cooling medium is usually circulated through the reactor core and the heat exchange system at relatively high pressure. If a centrifugal impeller is used, it is surrounded by a diffusing casing, and the required shape, large in diameter but of short axial length, is unsuited to withstand high internal pressures. The problem has been solved by arranging both impeller and diffusing casing within the existing pressure vessel surrounding a heat exchanger or the reactor core.

16069

NUCLEAR REACTOR AND PROCESS FOR CONVERTING NUCLEAR ENERGY INTO MECHANICAL AND/OR HEAT ENERGY. (to Stichting Reactor Centrum Nederland (Netherlands)). British Patent 789,937. Nuclear Eng. 3, 360(1958) Aug.

The reactor contains boiling active liquid (moderating liquid containing fissile material in solution and/or in a

finely divided state) in the reaction zone. This liquid is wholly or largely dispersed in vapor of the moderating liquid. The vapor is continuously withdrawn from the reaction zone being rendered free from entrained liquid and/or solid and utilized for the required mechanical energy (turbine) and/or heat energy (heat exchanger) while further moderating liquid is supplied continuously to the reaction zone to replace that withdrawn as vapor. A reactor of this type may be as large as desired in a lateral direction, so that production of energy may be made as large as desired while the height may be no more than 1 to 2 m. The decisive factor is the maximum permissible vapor velocity for the drops of liquid to be able to fall.

16070

NUCLEAR REACTORS. (to Stichting Reactor Centrum Nederland (Netherlands)). British Patent 789,117. Nuclear Eng. 3, 314(1958) July.

Reactors operating with water or heavy water containing fissile material in solution and/or in a finely divided state are described. The walls of the reaction zone, and solid structure within this zone, and the reflector surrounding it are constructed entirely of graphite.

16071

RADIATION SHIELDING CONTAINERS. (to Farrel-Birmingham Co. Inc. (U.S.A.)). British Patent 790,156. Nuclear Eng. 3, 360(1958) Aug.

A sectional container is described for radioactive material whose sections may be used either singly or in multiple so as to vary size and weight as required. The container comprises a cylindrical bottom part and an upper part which may be either the cover, or one or more intermediate sections and a cover. Each intermediate section has a frustro-conical or stepped boss on top, and a similarly shaped recess around the cylindrical portion forming the chamber for the radioactive material. The parts are individually screwed together and harmful rays cannot pass outwards through the joints.

16072

DEVICE FOR DETECTING RADIOACTIVITY. (to U. K. Atomic Energy Authority (U.S.A.)). British Patent 789,213. Nuclear Eng. 3, 314(1958) July.

Portions of a screen with a fluorescent surface arranged on a casing impervious to ordinary light but permeable to rays emitted by a radioactive surface can be covered with radioactivity-absorbent elements (lead strips) so that fluorescent and non-fluorescent portions provide contrasting patterns on the screen and aid the observer in the detection of fluorescence. The variations in the patterns observed also help to find the location of the radioactive source.

16073

CONTAINERS FOR RADIOACTIVE MATERIALS. R. G. Davis (to E. K. Cole, Ltd.). British Patent 790,319. Nuclear Eng. 3, 360(1958) Aug.

A shallow (pressed sheet metal) tray is described with a wide peripheral flange and a sheet-metal cover of similar external dimensions with an aperture locating a window of metallic foil hermetically sealed around the aperture for use as a thickness gage. As a sealing medium, an epoxide casting resin is employed. A metal washer may be inserted and for storage and transport a second metal cover is clamped on top for absorbing radiation passing through the window. The radioactive material is sealed in silver foil to form a wafer-like package in the shallow tray.

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